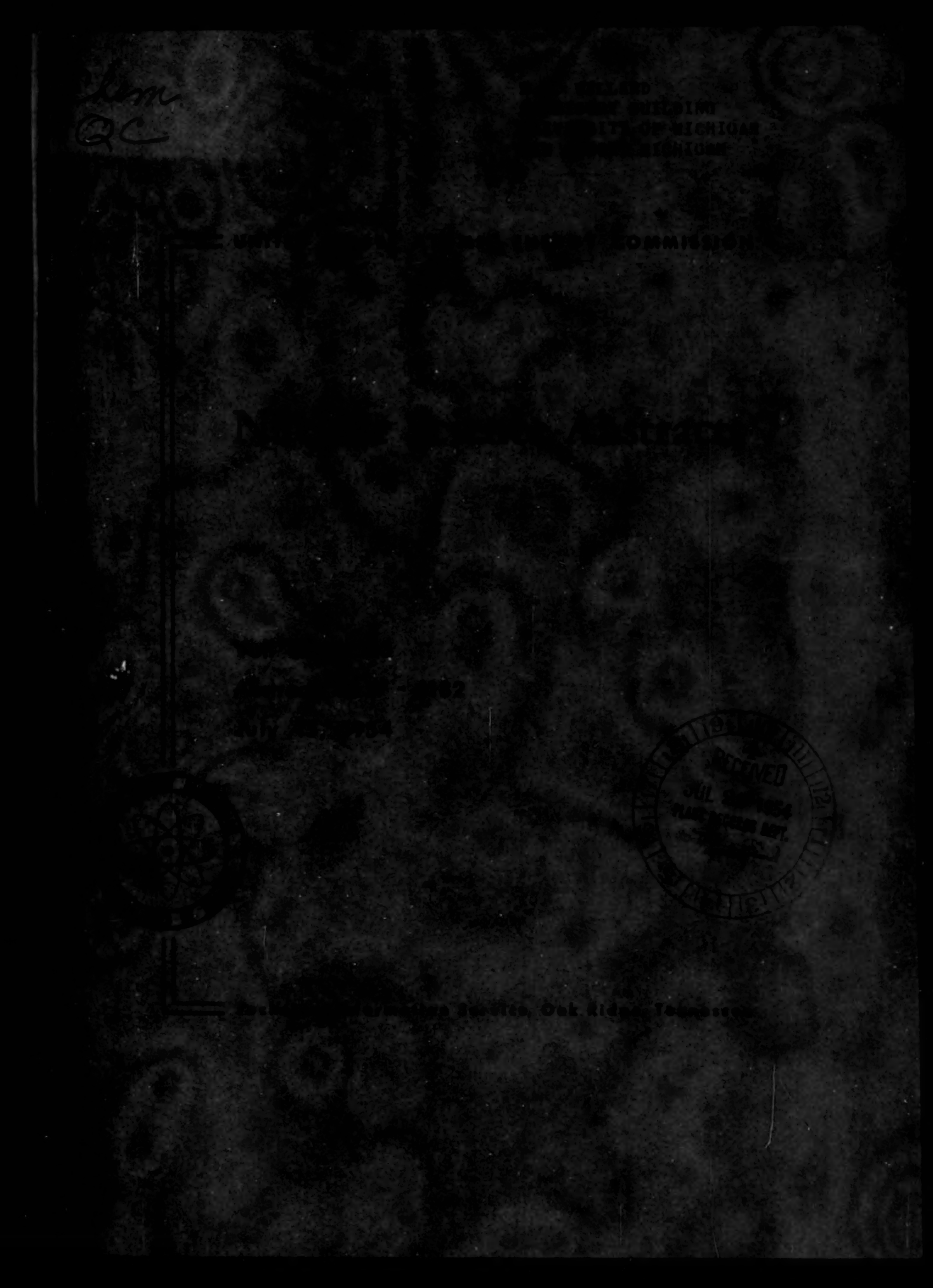

INTRODUCTION TO

NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

Vol. 8, No. 13, July 15, 1954

TABLE OF CONTENTS

Category	Abstract	Page
GENERAL	3937	471
Atomic Power	3937	
BIOLOGY AND MEDICINE	3940	471
Radiation Effects	3944	
Radiation Hazards and Protection	3961	
Radiation Sickness	3965	
Radiotherapy	3966	
Tracer Applications	3967	
Waste Disposal	3970	
CHEMISTRY	3971	475
Analytical Procedures	3999	
Atomic Weights and Periodic Systems	4004	
Crystallography and Crystal Structure	4005	
Fluorine and Fluorine Compounds	4006	
Laboratories and Equipment	4010	
Radiation Chemistry	4011	
Radiation Effects	4013	
Rare Earths and Rare-earth Compounds	4014	
Separation Procedures	4018	
Spectroscopy	4022	
Syntheses	4024	
Uranium and Uranium Compounds	4028	
Waste Disposal	4033	
ENGINEERING	4034	482
Heat Transfer and Fluid Flow	4035	
MINERALOGY, METALLURGY, AND CERAMICS	4040	483
Ceramics and Refractories	4040	
MINERALOGY, METALLURGY, AND CERAMICS		
Geology and Mineralogy	4041	
Metals and Metallurgy	4045	
PHYSICS	4073	486
Cosmic Radiation	4085	
Electrons	4090	
Gases	4094	
Instruments	4097	
Isotopes	4105	
Isotope Separation	4106	
Measuring Instruments and Techniques	4107	
Mesons	4113	
Molecular Properties	4121	
Nuclear Physics	4122	
Nuclear Properties	4127	
Nuclear Reactors	4139	
Nuclear Transformation	4141	
Particle Accelerators	4151	
Radiation Absorption and Scattering	4152	
Radiation Effects	4160	
Radioactivity	4163	
Spectroscopy	4174	
Theoretical Physics	4176	
Uranium and Uranium Compounds	4182	
AUTHOR INDEX		INDEX-1
NUMERICAL INDEX OF REPORTS		INDEX-5

NUCLEAR SCIENCE ABSTRACTS

Vol. 8 July 15, 1954 No. 13

GENERAL

ATOMIC POWER

3937

Tracerlab, Inc.

INVESTIGATIONS ON UTILIZATION OF RADIOACTIVE ENERGY AS A SOURCE OF BATTERY POWER. THIRD QUARTERLY PROGRESS REPORT [FOR] FEBRUARY 1, 1953 TO APRIL 30, 1953. Alexander Thomas and Victor Ragosine. 36p. Contract DA-36-039-SC-42549. (AD-14239)

Using a guessed-at value of the diffusion coefficient of aluminum in platinum, the thickness of the sputtered platinum layer on the aluminum electrode should probably be doubled if the battery voltage is to be maintained for fifteen years. Construction of the fill system for evacuating and pressure filling the battery models, contact potential difference measuring apparatus, and current-voltage measuring equipment is described. Experience with each of these pieces of equipment and analysis of initial measurements is presented. Experience in assembly of the first models, leading to minor modifications in design, is described. (auth)

3938

Livermore Research Lab., Calif. Research and Development Co.

ECONOMICS OF CENTRAL-STATION POWER PLANTS. PRELIMINARY COMPILATION OF REFERENCE DATA. R. T. Barham, R. C. Gerber, E. J. Haven, W. J. Starkey, and J. E. Viscardi. May 1954. 78p. Contract AT(11-1)-74. (LRL-128)

Statistical data such as costs and performance characteristics for several postwar power plants and trends in temperatures, pressures, capacities, efficiencies, and costs during the past fifty years are included. Among other general data included is a brief review of a theoretical steam cycle to show the effect on power costs, under broad basic assumptions, by variations in steam temperatures and pressures. This information can be particularly useful in establishing costs and specifications for a reference conventional plant which represents the competition of nuclear power plants. (auth)

3939

Technical Information Service, AEC

NUCLEAR ENGINEERING. A SELECTED LIST OF REFERENCES. Apr. 1954. 40p. (TID-3055)

This bibliography contains 480 annotated references to AEC reports and to the open literature. A list of pertinent bibliographies, an author index, and a report number index with availability information are also included. (auth)

BIOLOGY AND MEDICINE

3940

Los Alamos Scientific Lab.

BIOCHEMICAL ASPECTS OF ATHEROSCLEROSIS. R. Gordon Gould. [1953]. 19p. Contract [W-7405-eng-36]. (AECU-2867)

Recent studies of biochemical factors associated with atherosclerosis are reviewed. Topics briefly discussed include the synthesis, absorption, distribution, and metabolic pathways of cholesterol; factors involved in cholesterol homeostasis; the effects of sitosterol, dihydrocholesterol, and low fat diets on plasma cholesterol levels; the effects of estrogens on β lipoprotein levels; and biochemical studies on arterial tissues and on elastase. (C.H.)

3941

Argonne National Lab.

BIOLOGICAL AND MEDICAL RESEARCH DIVISION QUARTERLY REPORT. Apr. 1954. 81p. Contract W-31-109-eng-38. (ANL-5247)

Progress is reported in studies of the growth of the Krebs ascites tumor in mice; the pattern of Ra retention in man; the response of the hematopoietic system of dogs to injections of antileukocytic rabbit serum; modification of the radiation syndrome in the chick by shielding of the kidney or abdomen; metabolic requirements for recovery of irradiated Tetrahymena; the reflecting ability of normal leaves and primary and secondary bean plant leaves grown from irradiated seed; acute and chronic response of two hybrid mouse stocks to total-body x radiation; the toxicity of Sr^{89} in mice; the relative biological effectiveness of fast neutrons and Co^{60} γ radiation as measured by lethal effects on mice; metabolism of chloroplasts; studies of liver function tests; acid phosphatase activity of cytoplasmic particulates of rat liver isolated by gradient centrifugation; effects of irradiation on innate and acquired immunity; effects of radiation-protective agents on antibody formation in irradiated rabbits; variations in adsorption of bacterial viruses; origin of mitochondria in Paramecium; the response of cells to constant irradiation; neutron irradiation of phosphates and of bone; mechanisms of Ca transport and deposition; the tissue distribution of Sr^{90}-Y^{90} in dogs; the protective action of vasoconstrictor drugs against radiation mortality in the chick; the effect of age of mice on susceptibility to Be poisoning; the effect of Be on enzymatic reactions; and the toxicity of aurintricarboxylic acid in mice, and effects of ATA on Al or Fe poisoning. (C.H.)

3942

Atomic Energy Project, Univ. of Calif., Los Angeles

THE PLASMA LIPIDS IN FAT DEFICIENCY. James F. Mead and Dorothy L. Fillerup. May 10, 1954. 11p. Contract AT-04-1-Gen-12. (UCLA-291)

The composition of the plasma lipids of fat-deficient rats has been compared with that of normal fed and fasted animals using a recently developed chromatographic method. Total plasma lipid was about 65% of normal, but the distribution of the various classes was not significantly different with the exception of phospholipid which was significantly higher. (auth)

3943

THE USE OF RADIOACTIVE INDICATORS IN RADIOBIOLOGY. G. v. Hevesy. Strahlentherapie 93, 325-48(1954). (In German)

Several possibilities of using radioactive indicators in

radiobiology are discussed. In this connection the action of ionizing radiations on the velocity of the metabolism and on the formation of the compounds that are building up the tissue as well as on the permeability of the phase limits and on phagocytosis are investigated. (auth)

RADIATION EFFECTS

3944

Engineering Research Inst., Univ. of Mich.

UTILIZATION OF THE GROSS FISSION PRODUCTS. PROGRESS REPORT NO. 6. L. E. Brownell, L. C. Anderson, H. J. Gomberg, L. L. Kempe, J. J. Martin, J. V. Nehemias, G. T. Van Wylen, and E. T. Vincent. Mar. 1954. 266p. Contract AT(11-1)-162. (COO-198)

The effects of β radiation on the combustion of fuel in a diesel engine were found to be very small. Ethylene was polymerized, and toluene and chlorine were reacted in the presence of γ radiation. Taste-panel studies were shown to be a sensitive and statistically reliable method of determining flavor changes in food subjected to γ radiation. An increase in the satisfactory storage life of fruit was achieved with a radiation treatment at doses below that required for sterilization, but undesirable color changes in the fruit resulted. The use of Ce^{137} as a γ source is discussed. Preliminary results are discussed from an experiment in which the growth and reproductive capacities of rats fed a diet containing irradiated proteins, carbohydrates, and small amounts of fats and vitamins, over a period of two years and for three generations are being determined. A complete synthetic medium was subjected to various doses of γ radiation from Co^{60} and data are presented on the dose/growth response of Tetrahymena. Observations presented suggest the feasibility of radiosterilization of tissue-culture media. No changes in the tensile strength or modulus of elasticity were observed in glass fibers exposed to γ radiation. Data are included from studies of the effects of radiation on preservation of cut flowers, and the taste of beer. (For preceding period See COO-196) (C.H.)

3945

Air Force Radiation Lab., Univ. of Chicago

QUARTERLY PROGRESS REPORT NO. 11 Apr. 15, 1954. 106p. Contract AF-33(038)-27353. (NP-5155)

Progress is reported in studies of the additive effects of combinations of p-aminopropiophenone, cysteine, and β-mercaptoethylamine on the 5-nucleotidase activity of hematopoietic tissue, spleens, and thymus glands of irradiated rats; the effects of acute x irradiation on the phosphatases of mouse tissues; studies of the metabolism of hematopoietic tissues of irradiated animals; the effects of lethal and sublethal doses of x radiation on the acetylcholinesterase and other esterases of rat tissues; the effects of high-level x irradiation on enzyme systems of rat tissues; the effects of various cholinergic agents on the mortality, survival time, and weight loss of x-irradiated rats; the effect of the administration of various muscle relaxants on the ultimate mortality of mice previously exposed to whole-body x radiation; the effects of whole-body x radiation on hexokinase activity of rat tissues; the therapeutic effects of injections of nonirradiated protoplasm in x-irradiated giant amoeba; the effect of inhalation of hydrogen, ethylene, or nitrous oxide on the survival time of x-irradiated mice; and the effect of p-aminopropiophenone and cysteine on the spleen adenosine phosphate level of irradiated rats. A number of chemical agents were screened for their prophylactic or therapeutic effects against radiation mortality in mice, and data are tabulated. (For preceding period see NP-5055.) (C.H.)

3946

Massachusetts Inst. of Tech.

BACTERICIDAL EFFECTS OF IONIZING RADIATIONS AS INFLUENCED BY DIFFERENT CONDITIONS OF ATMOSPHERE, MEDIUM, AND PHYSICAL STATE IN WHICH SAMPLES ARE IRRADIATED. QUARTERLY PROGRESS REPORT FOR THE PERIOD OCTOBER 1, 1953 TO DECEMBER 31, 1953. Bernard E. Proctor and Samuel A. Goldblith. Jan. 1, 1954. 73p. Contract AT (30-1)-1164, Report No. 6. (NYO-3342)

Data are presented from an experimental investigation wherein the effects of several different conditions upon the bactericidal action of ionizing radiations were studied. These conditions include atmospheres of oxygen, air, inert gases, and vacuum; nutrient and non-nutrient suspension media; the solid (frozen) and liquid states of the suspension; and different volumes and thicknesses of the bacterial suspensions. Radiation sources used were a kilocurie Co^{60} source and a 3 Mev Van de Graaff accelerator. The results are examined from both practical and theoretical points of view. (For preceding period see NYO-3341.) (auth)

3947

Massachusetts Inst. of Tech.

QUARTERLY PROGRESS REPORT FOR THE PERIOD JANUARY 1, 1954 TO MARCH 31, 1954. Bernard E. Proctor and Samuel A. Goldblith. Apr. 1, 1954. 11p. Contract AT (30-1)-1164, Report No. 7. (NYO-3343)

In addition to continuation of the studies of the bactericidal effects of ionizing radiations as influenced by different conditions of atmosphere, medium, and physical state in which the samples are irradiated, studies have been made on the possibility of utilizing silver-activated phosphate glass as a dosimeter for high intensity sources of gamma rays and cathode rays. The preliminary results are described herein. (For preceding period see NYO-3342.) (auth)

3948

Technical Information Service, AEC

BIOLOGICAL EFFECTS OF NEUTRONS, GAMMA RADIATION, AND NEUTRON-GAMMA COMBINATIONS. A SELECTIVE BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE. Lore Rose David, comp. May 1954. 38p. (TID-3052)

An annotated bibliography of 190 items is presented, covering AEC report literature and selected references from the open literature on biological effects of neutrons, gamma radiations, and combinations of both. (auth)

3949

Atomic Energy Project, Univ. of Rochester

AN EVALUATION OF THE PULMONARY RADIATION DOSAGE FROM RADON AND ITS DAUGHTER PRODUCTS. Jacob Shapiro. Apr. 9, 1954. 150p. Contract W-7401-eng-49. (UR-298)

The pulmonary radiation dosage from the radon-radon daughter product atmosphere was investigated in experiments in which measurements were made of the radioactivity deposited in the lungs of rats and dogs breathing in an exposure chamber containing 2×10^{-8} curies-liter radon. The chamber was $2' \times 3' \times 6'$. The results of these experiments indicate that most of the radiation dosage to the lungs is produced by these daughter products, removed as particulates from the air, rather than by gaseous radon and the daughter products of the radon molecules decaying in the lungs. (auth)

3950

Naval Radiological Defense Lab.

THE RESPONSE OF ENDOMETRIAL INTRAOCULAR IMPLANTS FOLLOWING TOTAL AND REGIONAL X IRRADIATION OF THE HOST. E. M. Jacobsen, D. J. Kimeldorf, and S. J. Baum. Feb. 10, 1954. 20p. (USNRDL-425)

Intraocular endometrial implants in mature female Dutch rabbits responded to the effects of total-body x irradiation (800 r) by an immediate increase in area within 24 to 48 hr post-irradiation. This effect was sustained, but to a lesser

Chem.
H. W. Willard
gift

degree, for at least eight days post-irradiation. In contrast, the implants in sham irradiated controls exhibited only a slight increase in area during the thirty days of observation. When animals were regionally exposed to x rays by use of lead shields, only those combinations of shields which permitted exposure of the pituitary region resulted in a sudden surge of implant growth. It appears that either total-body irradiation or local irradiation of the pituitary region can effectively alter the pituitary-gonadal axis in this species as evidenced by intraocular endometrial growth changes and by the macroscopic appearance of genital tissues in situ. (auth)

3951

Naval Radiological Defense Lab.

ANEMIA OF THERMAL INJURY. STUDIES OF RADIOIRON UTILIZATION AND ERYTHROCYTE LIFE SPAN IN RATS. W. M. Davis, E. L. Alpen, and A. K. Davis. Mar. 19, 1954. 31p. (USNRDL-433; AFSWP-733)

The anemia of thermal injury has been investigated in rats subjected to high intensity radiant energy thermal burns. Observations of Fe^{59} utilization following tracer injection have been made in control and burned animals at 2, 7, and 15 days post-burn and indicate an accelerated rate of Fe^{59} uptake in burned animals. Utilizing subsequent iron loading techniques, these same labeled erythrocytes have been used for measurement of erythrocyte life span in the same control and burned animals. The mean erythrocyte life span of normal rats has been found to be 51 ± 5 days; the mean erythrocyte life span of burned animals has been measured as 27 ± 4 days. The burned animal shows early and continuing random destruction of erythrocytes at a rate greater than normal. This hemolytic process is compensated for in the rat by increased rates of medullary and extramedullary hematopoiesis as is indicated by the normal red cell volume and sustained reticulocytosis seen following thermal injury. (auth)

3952

PATHOLOGIC CHANGES IN NORMAL HUMAN THYROID TISSUE FOLLOWING LARGE DOSES OF I-131. Gould A. Andrews, Ralph M. Kniseley, Robert R. Bigelow, Samuel W. Root, and Marshall Brucer (Oak Ridge Inst. of Nuclear Studies, Tenn.). Am. J. Med. 16, 372-81(1954) Mar.

The early histologic changes which occur in normal thyroid tissue after relatively large doses of I^{131} are described on the basis of information obtained from ten patients. Because of variations in size of the gland and differences in concentration and retention of the isotope, the radiation dose to the thyroid tissue is not closely correlated with the total dose administered. Even when all of the factors known to influence tissue radiation dosage are considered, it is not possible to predict the biologic response on the basis of dosage. The accomplishment of complete destruction of the thyroid by means of a single, safe dose of radioiodine is a rather uncertain procedure. In some cases large total doses have failed to cause complete necrosis of the gland. (auth)

3953

THE LETHAL FLUX OF NEUTRONS AT ENERGIES UP TO 3 MEV. L. Cave (Coll. of Science, Shrivenham, Wilts, England). Brit. J. Radiol. 27, 273-82(1954) May.

The 50 per cent lethal flux of neutrons at energies up to 3 Mev is calculated from the assumptions that the 50 per cent lethal dose of γ rays is 400 r, the relative biological efficiency of protons is 6.5, and that the criterion for lethal effects is the equivalent amount of ionization produced in the whole body. For isotropic incidence the 50 per cent lethal flux varies from 1.6×10^{12} n/cm^2 at thermal energy to 1.7×10^{10} n/cm^2 at 3 Mev. (auth)

3954

LETHAL EFFECT OF ULTRAVIOLET AND X-RADIATION ON THE PROTOZOAN FLAGELLATE ASTASIA LONGA. Henry W. Schoenborn (Univ. of Georgia, Athens). Physiol. Zoöl. 26, 312-19(1953) Oct.

Sigmoid survival curves were obtained after subjecting a protozoan flagellate, A. longa strain J, to either x-rays or ultraviolet light. The phenomenon of photoreactivation was observed following ultraviolet irradiation. (auth)

3955

EFFECT OF TOTAL BODY X-IRRADIATION ON THE TRYPTOPHANE PEROXIDASE ACTIVITY OF RAT LIVER. John F. Thomson and Eleanor T. Mikuta (Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 85, 29-32(1954).

Total-body x irradiation produces within a few hours a dose-dependent increase in the tryptophane peroxidase-oxidase system of rat liver. The increase does not occur in adrenalectomized rats and hence cannot be construed as a direct effect of x irradiation. (auth)

3956

IRRADIATION OF PARTS OF INDIVIDUAL CELLS. Raymond E. Zirkle and William Bloom (Univ. of Chicago). Science 117, 487-93(1953) May 8.

A widely applicable method is described for high-energy irradiation of cell parts by use of proton microbeams with diameters as small as 2.5μ. In mitotic cells of newt heart cultures, a few dozen protons to chromosomes produce severe aberrations, whereas a few thousand to cytoplasm, spindle, or centriolar region are without detectable effect. Some of these types of chromosome aberrations are readily localized and help in the study of certain aspects of mitotic movement. (auth)

3957

OXYGEN POISONING AND X-IRRADIATION: A MECHANISM IN COMMON. Rebeca Gerschman, Daniel L. Gilbert, Sylvanus W. Nye, Peter Dwyer, and Wallace O. Fenn. (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Science 119, 623-5(1954) May 7.

Physiological mechanisms common to both oxygen poisoning and x-radiation injuries are discussed. From the experiments reported and the considerations presented, it is concluded that both irradiation and oxygen poisoning produce some of their lethal effects through at least one common mechanism, possibly that of the formation of oxidizing free radicals. (C.H.)

3958

STUDY OF THE THYROID FUNCTION IN THE IRRADIATED ANIMAL. P. Marques, A. Bru, H. Planel, A. Serres, and L. Chardon. J. radiol et electrol. 35, No. 1-2, 15-21(1954). (In French)

The thyroid function in the course of radiation sickness was studied in 32 dogs and 30 guinea pigs which received total-body irradiation or total-body irradiation with the thyroid protected. The animals received a lethal dose. Thyroid functioning was followed with I^{131}. Total irradiation caused a slight lessening of iodide fixation in the period before radiation injuries were manifest and a large decrease in iodide fixation after indications of radiation sickness. The histological modifications were evident only in the latter period. If the thyroid was protected during the irradiation, the iodide fixation was more nearly normal. (J.S.R.)

3959

IMPAIRED ORGANIC BINDING OF RADIOIODINE BY THE THYROID FOLLOWING RADIOIODINE TREATMENT OF HYPERTHYROIDISM. Richard H. Kirkland (Medical Coll. of Virginia, Richmond). J. Clin. Endocrinol. and Metabolism 14, 565-71(1954) May.

The administration of sodium thiocyanate during a tracer

study performed eight weeks after the treatment of hyperthyroid patients with radioiodine brings about a rapid discharge of the trapped tracer iodide from the thyroid. This seems to indicate that many cases show impaired organic binding of trapped radioiodine eight weeks after therapy. It is suggested that radioiodine acts upon the thyroid in such a manner as to prevent or impair organic binding of the trapped iodide. (auth)

3960

EFFECT OF THYROTROPIN ON CHANGES IN THYROID FUNCTION FOLLOWING ADMINISTRATION OF I^{131} TO EUTHYROID CARDIAC PATIENTS. G. S. Kurland, A. S. Freedberg, and J. Fishman (Harvard Univ. Medical School, Boston, Mass.). J. Clin. Endocrinol. and Metabolism 14, 572-8(1954) May.

Thyrotropic hormone was found to stimulte I^{131} uptake when administered as long as 54 days following the initial therapeutic dose of I^{131} administered to patients with angina pectoris or congestive heart failure. It had no effect on the I^{131} uptake of a patient in whom myxedema had been induced eighteen months previously. (C.H.)

RADIATION HAZARDS AND PROTECTION

3961

PROTECTIVE ACTION OF LOW OXYGEN TENSION AND EPINEPHRINE AGAINST X-RAY MORTALITY IN THE CHICK. S. Phyllis Stearner, Emily J. B. Christian, and Austin M. Brues (Argonne National Lab., Lemont, Ill.). Am. J. Physiol. 176, 455-60(1954) Mar.

Epinephrine in oil, as well as low oxygen tension, markedly reduced radiation mortality in young chicks, while combined treatment had a synergistic, protective effect. It is postulated that the decreased supply of oxygen to the tissues produced by exposure at low oxygen tension is augmented by epinephrine so that a more severe hypoxia of the visceral organs is produced. Apparently, the protective action of either treatment is upon the initial phase of the chain of events initiated by irradiation. (auth)

3962

INVESTIGATIONS ON BIOLOGICAL RADIATION PROTECTION. V. FURTHER INVESTIGATIONS ON THE EFFECT OF HETEROLOGOUS SUPRARENAL IMPLANTATION ON THE SURVIVAL RATE OF THE X-IRRADIATED MOUSE. H. Langendorff, R. Koch, and H. Sauer. Strahlentherapie 93, 381-8(1954). (In German). (cf. NSA 8-3207 and 8-3208)

Experiments were made with 831 and female mice. Following a total body irradiation with 650 or 500 r, heterologous adrenal tissue (rats) was implanted into the mice. This resulted in an increase of the survival rate from 8 to 20% for the male, and from 10 to 52% for the female animals irradiated with 500 r. In the animals irradiated with 650 r, the implantation proved to have no influence on the survival rate. (auth)

3963

THE EFFECT OF LEVULOSE ON RADIATION SICKNESS. K. Fochem. (Universitäts- Frauenklinik Wien, Austria). Strahlentherapie, 93, 466-72(1954). (In German)

Fructose can be used in radiation sickness to detoxicate the liver and diminish unpleasant side effects. The damage to the liver during high dosages of x irradiation and the therapeutic effects of fructose were determined by means of the bromosulfophthalein test. (J.S.R.)

3964

ANOXIA AS A FACTOR OF RADIORESISTANCE. A. Lacassagne. J. radiol. et electrol. 35, No. 1-2, 12-15 (1954). (In French)

The mechanism of radioresistance appears to be the lessening of the reactions of secondary oxidations, caused by the oxidizing agents freed by irradiation. The best means, therefore, of augmenting radioresistance consists of diminishing the amount of free O_2 in the tissues. (J.S.R.)

RADIATION SICKNESS

3965

ON THE PERCUTANEOUS RADIATION EFFECT OF THORIUM X. Eberhard Günsel (Strahlenabteilung des Kreiskrankenhauses, Ludwigsburg, German). Strahlentherapie 93, 573-8(1954). (In German)

Experimental investigations in young rats have shown that gamma rays of Ra^{224} is important enough to bring about radiation sickness, death, and strong reactions of the bone marrow. Upon direct exposure, the zones of cartilage growth show radiation damages as well as atrophic alterations of the testicles. Apart from somatic damages, genetic damages are also likely to occur, particularly in the treatment of hemangioma in children. Determination of the tolerance dose of Ra^{224} should therefore be included in the general determinations of tolerance doses in radiotherapeutical institutions. (auth)

RADIOTHERAPY

3966

A TREATMENT OF ERYTHREMIA BY RADIOACTIVE PHOSPHORUS. N. V. Nikolayeva (Central Inst. of Hematol. and Blood Transfusion, Moscow). Klin. Med. 31, No. 12, 12-15(1953) Dec.

A method is described for treating erythremia, which combines blood-letting, the injection of plasma, and the administration of an average dose of 4 to 6 mc of P^{32}. Clinical experience demonstrated the advantages of this treatment in decreasing the chances of anemia and eliminating prolonged hospitalization of patients suffering from erythremia. (C. H.)

TRACER APPLICATIONS

3967

Radiation Lab., Univ. of Calif., Berkeley

ISOLATION OF MANNOHEPTULOSE AND IDENTIFICATION OF ITS PHOSPHATE IN AVOCADO LEAVES. A. Nordal and A. A. Benson. Mar. 1954. 8p. Contract W-7405-eng-48. (UCRL-2530)

Mannoheptulose accumulates in avocado leaves and occasionally in the fruit. Isolation of this sugar and perseitol in good yield from avocado leaves is described. Brief photosynthesis in $C^{14}O_2$ produced labeled mannoheptulose monophosphate as well as sedoheptulose monophosphate and intermediates of carbohydrate synthesis. It was hydrolyzed to free mannoheptulose which was identified chromatographically. Paper chromatographic separation of borate complexes of these heptuloses and the hexoses has been accomplished. (auth)

3968

Atomic Energy Project, Univ. of Rochester

THE EFFECTS OF A MAINTAINED BODY BURDEN OF POLONIUM IN RATS. [PART] 1. PILOT DISTRIBUTION AND EXCRETION EXPERIMENT. J. N. Stannard. Apr. 27, 1954. 21p. Contract W-7401-eng-49. (UR-329)

The kinetics of excretion and total retention of Po^{210} by rats following five small weekly doses are substantially the same over a period of 49 days as when a comparable total amount is administered in a single dose. The excretion half life is 50 to 55 days and the effective half life is 37 to 39 days. This is slightly longer than previously reported values of 30 to 35 days in the rat and of 30 days for the mouse, but is not considered significantly different. Tissue distribution is not altered by dividing the dose with the possible exception of red blood cells which showed a lower relative concentration. The doses given would not produce observable

radiation damage in 49 days. These data are to be used for a large multiple dose experiment to be reported subsequently. (auth)

3969
USE OF RADIOACTIVE PHOSPHORUS IN DETECTION OF INTRAOCULAR NEOPLASMS. I. J. Eisenberg, I. H. Leopold, and D. Sklaroff (Wills Eye Hospital, Philadelphia, Penna.). Arch. Ophthalmol. 51, 633-41(1954) May

The differential uptake of diiodofluorescein and P^{32} in suspected intraocular neoplasms was investigated. Initial results were unsatisfactory in three patients in whom diiodofluorescein was used. The uptake of P^{32} was studied in nine cases with a clinical diagnosis of serious retinal detachments. Results indicate that intraocular neoplasms will concentrate P^{32}, and it was concluded that this may be used as a diagnostic test in conjunction with clinical judgement and experience. (C.H.)

WASTE DISPOSAL

3970
REMOVAL OF RADIOACTIVE SUBSTANCES FROM WATER BY BIOLOGICAL TREATMENT PROCESSES. G. E. Eden, G. H. J. Elkins, and G. A. Truesdale. Atomics 5, 133-42, 158(1954) May.

Techniques for the romoval of radioactive contaminants from water and sewage are reviewed. The methods generally involve the use of an aerobic bacterial slime, supported on grains of sand to form a slow sand filter, or suspended as a flocculent sludge. The efficiency of both processes for removing several more common radioisotopes is quantitatively investigated. (K. S.)

CHEMISTRY

3971
Argonne National Lab.
PREPARATION OF METHYL BORATE FROM BORON TRIFLUORIDE. Raymond F. Barnes, Herbert Diamond, and Paul R. Fields. Mar. 1954. 3p. Contract W-31-109-eng-38. (ANL-5243)

The preparation of $B(OCH_3)_3$ by direct reaction of BF_3 (as the BF_3–ether complex) with $NaOCH_3$ in anhydrous CH_3OH is discussed. The $B(OCH_3)_3$ was separated from the reaction products by distillation as an azeotropic mixture with CH_3OH, and from the latter by the LiCl salting method. (J.A.G.)

3972
Los Alamos Scientific Lab.
LIQUID SOLUTION SCINTILLATORS. F[rancis] Newton Hayes, Betty S. Rogers, Phyllis Sanders, Robert L. Schuch, and D. Lloyd Williams. Oct. 1953. 75p. Contract W-7405-eng-36. (LA-1639)

Various oxazoles, 1, 3, 4-oxadiazoles and oxazole quaternary salts have been synthesized. Thirty-eight of these are now reported as new compounds. Emission spectra of 3 g/l toluene solutions of these solutes have been run with radium excitation. Energy transfer between solutes has been noted by this method with toluene solutions of two solutes. Fine absorption spectra in cyclohexane solution and photon mean free path data have been obtained. Solvents have been studied as to their light absorption and chemical properties of peculiar interest in scintillation work. Relative photomultiplier anode current and pulse height methods of testing have been applied to liquid solution scintillators and have given information directly applicable to counting problems. Uses are described for these solutions in H^3 and C^{14} assay in work of biological interest, natural C^{14} counting, and detection of the free neutrino. (auth)

3973
Saint Olaf Coll.
PREPARATION AND PROPERTIES OF INORGANIC HYDRIDES. PERIOD COVERED: AUGUST 31, 1951 TO DECEMBER 31, 1953. Albert E. Finholt. Mar. 1, 1954. 18p. Contract Nonr-664(00), Technical Report No. 2. Includes two reprints: THE REDUCTION OF ISOCYANATES AND ISOTHIOCYANATES WITH LITHIUM ALUMINUM HYDRIDE. A[lbert] E. Finholt, Charles Dean Anderson, and C. L. Agre. J. Org. Chem. 18, 1338-40(1953), and THE REDUCTION OF CARBON DIOXIDE TO FORMIC ACID WITH LITHIUM ALUMINUM HYDRIDE. Albert E. Finholt and Eugene C. Jacobson. J. Am. Chem. Soc. 74, 3943-4(1952). (NP-5153)

A new procedure is described for the preparation of alkali metal aluminum hydrides which is reported to be more economical than the present industrial process. Data are presented on the reaction of nickel carbonyl with lithium aluminum hydride and with aluminum hydride; the reduction of alkyl and aryl isocyanates and isothiocyanates with lithium aluminum hydride; and the reduction of organic compounds with sodium aluminum hydride. (C.H.)

3974
Tuft Coll.
INVESTIGATIONS ON ALUMINUM HYDRIDE. Gordon G. Evans. Apr. 30, 1954. 34p. Contract ONR-494(04). (NP-5154)

A conductometric study of the reaction between $AlCl_3$ and $LiAlH_4$ (whereby AlH_3 is formed) has been completed, and a theory has been devised to account for the form of the titration curves observed in ethyl ether solution. The compound $AlHCl_2.(C_2H_5)_2O$ was prepared from AlH_3 and $AlCl_3$ in ether solution, and its properties studied. The end point in the titration in $LiAlH_4$ with $AlCl_3$ can be determined potentiometrically in tetrahydrofuran solutions but not in ether solutions. A device for exposing cooled metal samples to the action of atomic hydrogen has been put into operation, and also a device for simultaneously preparing and sealing into glass, without exposure to air or moisture, several mixtures of small variable amounts of reactive solutions. Observations have been made which suggest that the precipitation of aluminum hydride polymer is a process sensitive to catalysis. (C.H.)

3975
Stanford Research Inst.
DETERMINATION OF THE MECHANISM OF THE INCREASE OF VISCOSITY OF ORGANOSILICON COMPOUNDS AT HIGH TEMPERATURES. QUARTERLY PROGRESS REPORT NO. 27 FOR DECEMBER 23, 1953 TO MARCH 23, 1954. O. F. Senn. Apr. 27, 1954. 31p. Contract AF 33(616)-168. (NP-5168)

Oxidation rate studies with and without the presence of steel, titanium, and copper have been made for hexa(2-ethyl-1-butoxy)disiloxane, tetra(3-methyl-1-butoxy)silane, and tetra(2-methyl-1-butoxy)silane. These studies indicate that, up to 150°C, the test metals have no effect upon the oxidation rate of the alkoxysilanes studies. Hydrolysis rate studies at elevated temperatures for tetra(3-methyl-1-butoxy)silane and tetra(2-methyl-1-butoxy) silane have been completed. Additional studies of the hydrolytic susceptibility of the isomeric pentoxysilanes are in progress. (auth)

3976
Petroleum Refining Lab., Penna. State Coll. School of Chemistry and Physics
FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. QUARTERLY PROGRESS REPORT FOR APRIL, MAY, AND JUNE 1953. Sept. 16, 1953. 67p. Contract AF33(038)-18193. (PRL-5.7)

Progress is reported in the development of synthetic

turboprop lubricants, the evaluation of esters as base stocks for synthetic fluids and lubricants, studies of metal deactivators, studies of the hindered phenol-alkyl acid phosphite oxidation inhibitor combination, oxidation studies at 400°F, oxidation and corrosion stability at 500°F, design of a high-temperature bath, and a pressure cylinder for high-temperature thermal stability studies. Variables and factors relating to the control and measurement of viscosity and viscosity-stability of fluids and lubricants, and the quantity production of hydraulic fluids are discussed. (For preceding period see NP-4848.) (C.H.)

3977

Technical Information Service, AEC

POLAROGRAPHY. A TITLE LIST OF UNCLASSIFIED REPORT LITERATURE. Hugh E. Voress, comp. May 6, 1954. 9p. (TID-3057)

3978

Radiation Lab., Univ. of Calif. Berkeley

PHOTOCHEMISTRY OF PORPHYRINS (thesis). Gilbert Randall Seely. Nov. 1953. 120p. Contract W-7405-eng-48. (UCRL-2417)

A study was made of the photochemical hydrogenation of a synthetic porphyrin, zinc tetraphenylporphin. A number of substances, including benzoin, ascorbic acid, dihydroxyacetone, hydrazobenzene, and hexyl mercaptan, showed ability to hydrogenate the porphyrin in the presence of light. The principal reduction product was identified as tetrahydroporphin, and its spectrum was established. Also found under special conditions was a compound believed to be zinc hexahydrotetraphenylporphin, which was oxidized by oxygen in the dark to tetrahydroporphin. Data are included on the kinetics of the photochemical reduction of zinc tetraphenylporphin by benzoin, the benzoin-catalyzed destructive oxidation of Zn tetraphenylporphin, and the oxidation of Zn tetrahydrotetraphenylporphin by phenanthraquinone. (C.H.)

3979

Radiation Lab., Univ. of Calif., Berkeley

THE BISULFITE ADDITION COMPOUNDS OF CODEINE KETONES. Henry Rapoport and Calvin H. Lovell. Mar. 1954. 7p. Contract W-7405-eng-48. (UCRL-2527)

Data are tabulated from determinations of the specific rotations and partition coefficients of some ketonic and nonketonic codeine derivatives in the absence and in the presence of bisulfite. (C.H.)

3980

Radiation Lab., Univ. of Calif., Livermore

THE LIQUID AMMONIA CHEMISTRY OF BORON. William L. Jolly. Apr. 19, 1954. 17p. Contract W-7405-eng-48. (UCRL-4332)

The chemistry of B with respect to liquid NH_3 as a solvent is reviewed. Particular emphasis is placed on the chemistry of substituted borines, the boron hydrides, and borohydrides. (auth)

3981

THE CHEMISTRY OF CONDENSED PHOSPHATES AND ARSENATES. PART 3. THE MANUFACTURE AND PROPERTIES OF META-ARSENATOPHOSPHATES AND THE CONSTITUTION OF MADDRELL'S SALT $(NaPO_3)_x$. Erich Thilo and Ilse Plaetschke. Translated from Z. anorg. Chem. 260, 297-314(1949). 19p. (AEC-tr-1895)

3982

STRUCTURE AND STABILITY IN SOME CHELATES OF ANALYTICAL SIGNIFICANCE. Henry Freiser (Univ. of Pittsburgh, Penna.). Record Chem. Progr. (Kresge-Hooker Sci. Lib.) 14, No. 4, 199-206(1953).

The influence of steric factors on chelate stabilities is discussed. The ΔH and ΔS values for the formation of chelates of 2-methyl-8-hydroxyquinoline were determined and tabulated. In all cases the heats of chelation for chelates of the 2-substituted hydroxyquinoline are only half that found for the 4-methyl compounds, indicating steric hindrance for the 2-methyl compound. A plot of the thermodynamic functions of the alkylated 8-hydroxyquinoline against the atomic radii decrease. An evaluation of the effect of ring size on chelate stability indicates that the six-membered ring analogs of 8-hydroxyquinoline do not have the chelating ability of the five-membered ring. (J.S.R.)

3983

CHEMICAL INTERACTIONS IN THE SYSTEMS $V_2O_5-K_2SO_4$ AND $V_2O_5-K_2S_2O_7$. G. K. Boreskov, V. V. Illarionov, R. P. Ozerov, and E. V. Kul'disheva. Zhur. Obshcheĭ Khim. 24, 23-9(1954) Jan. (In Russian).

A thermographic and x-ray investigation of the systems $V_2O_5-K_2SO_4$ and $V_2O_5-K_2S_2O_7$ was made. In the system $V_2O_5-K_2SO_4$ a compound with the approximate composition $V_2O_5 \cdot K_2SO_4$ and a fusion temperature of 500° was found. A eutectic, formed between this compound and K_2SO_4 at 430°, contains approximately 0.4 mole % V_2O_5. An approximate phase diagram was constructed. In the system $V_2O_5-K_2S_2O_7$ the fusion temperature is low, and, on cooling, glass is produced. An exothermic effect was found at 275°. This effect explains the formation of a compound $V_2O_5 \cdot K_2S_2O_7$. (tr-auth)

3984

DECONTAMINATION OF RADIOACTIVELY CONTAMINATED WATER BY SLURRYING WITH CLAY. William J. Lacy. (Engineering Research and Development Labs., Fort Belvoir, Va.) Ind. Eng. Chem. 46, 1061-5(1954) May

In the event of an atomic, radiological, or hydrogen bomb attack, water supplies may become contaminated with radioactive materials. Clay, because of its adsorptive and ion exchange capacity, may be effectively used to decontaminate polluted supplies. Results obtained using tap water deliberately contaminated with selected radioisotopes and fission product mixtures indicate clay to be particularly effective for removing $Ce^{141,144}-Pr^{144}$, $Zr^{95}-Nb^{95}$, $Ba^{140}-La^{140}$, and $Sr^{90}-Y^{90}$. Clay is less effective for $Ru^{106}-Rh^{106}$ and very poor for I^{131}. A clay dosage of 1000 ppm appears to be adequate. Increased dosages are wasteful of clay. Varying the calcium ion concentration from 0 to 200 ppm has little or no effect on the removal of mixed fission products. Elevated pH (over 5) favors the removal of mixed fission products. Effectiveness of coagulation and filtration in removing dissolved radioactive contaminants can be materially bettered by preliminary slurrying with clay or by addition of clay directly to the water during coagulation along with the coagulating chemicals. (auth)

3985

CARBON-13 ISOTOPE EFFECT IN THE THERMODECOMPOSITION OF NICKEL CARBONYL. Richard B. Bernstein (Illinois Inst. of Tech., Chicago). J. Chem. Phys. 22, 710-13(1954) Apr.

The $C^{12}-C^{13}$ fractionation factor in the decomposition of gaseous nickel carbonyl has been measured from 30 to 105°C, using samples of normal isotope abundance. Assuming that the rate-determining step is the rupture of a Ni–C bond, the rate constants are defined as follows:

$$Ni(CO)_4 \longrightarrow Ni(CO)_3 \cdot + CO \quad k_1,$$

$$Ni(CO)_3C^*O- \begin{cases} \longrightarrow Ni(CO)_3 \cdot + C^*O & k_2, \\ \longrightarrow Ni(CO)_2C^*O \cdot + CO & k_3, \end{cases}$$

The C^{12} enrichment of the first fraction of CO from decomposition gives, over the temperature range studied, $k_1/(k_2 + k_3) = 1.0222 - 6.7 \times 10^{-5}t(°C)$. The intramolecular

and intermolecular isotope effects are defined as $k_3/3k_2$ and $k_1/4k_2$, respectively. The magnitude of the intramolecular effect was assumed to be given by the square root of the usual reduced mass ratio, with a value of 1.0345. Thus the intermolecular effect calculated from the data becomes $k_1/4k_2 = 1.0481 - 6.7 \times 10^{-5}t(°C)$. A theoretical estimate of the magnitude of the intermolecular effect was made using the method of Bigeleisen. Isotopic shifts in vibrational frequencies were computed, and the usual assumptions regarding the vibrations of the activated complex were made. The calculated isotope effect was somewhat smaller than that observed. (auth)

3986

POLAROGRAPHIC CHARACTERISTICS OF +5 VANADIUM IN PHOSPHATE, BORATE AND CARBONATE BUFFERS. I. Filipović, Z. Hahl, Z. Gašparac, and V. Klemenčić (Univ. of Zagreb, Croatia, Yugoslavia). J. Am. Chem. Soc. 76, 2074-80(1954) Apr. 20.

The polarographic behavior of +5 vanadium has been studied in phosphate, borate, and carbonate buffers in the range from pH 2 to 12.5. The dependence of half-wave potential and height of polarographic waves on pH have been determined. In phosphate buffer at pH < 2, the two waves produced correspond to the reversible electrode reduction of +5 to +4 vanadium and to the irreversible electrode reduction of +4 vanadium to the +2 state, respectively. From pH 2 to 9 four waves are developed: the first two correspond to the adsorption-reduction of hydrogen polyvanadate ions; the third wave to the irreversible electrode reduction of +5 to +4 vanadium; and the fourth to a reduction of +4 to +2 vanadium. With increasing pH the adsorption current falls and at pH 9 the adsorption wave disappears. From pH 9 to 12.5, in all three buffers, only two waves remain; the first, which corresponds to the reduction of +5 to +4 vanadium, decreases and the second, which partly corresponds to a reduction of +5 to +4 vanadium, increases with increasing pH. Above pH 12.5 a single wave is left, corresponding to a reduction of +5 to +2 vanadium. These results are attributable to the existence of five different kinds of +5 vanadium ions in equilibrium in the interval of pH examined. Two well developed waves arise about 0.5 v apart in borate solution. (auth)

3987

PREPARATION AND POLYMERIZATION OF UNSATURATED QUATERNARY AMMONIUM COMPOUNDS. VI. DERIVATIVES OF 1,4-DIAMINOBUTENE-2. George B. Butler and Robert L. Goette (Univ. of Florida, Gainesville). J. Am Chem. Soc. 76, 2418-21(1954) May 5.

Eight unsaturated quaternary ammonium bromides and one unsaturated tertiary amine have been prepared and characterized. The quaternary ammonium bromides were polymerized by use of peroxide catalysts, and some of the properties of the polymers determined. It was shown that the double bond of the butene-2 structure did not enter into the polymerization, and that this residual double bond caused a decrease in the basic properties of the resulting polymer. (auth)

3988

A CONVENIENT TRANSFORMATION OF RADIOACTIVE CARBON DIOXIDE INTO RADIOACTIVE CYANIDE. Wyman R. Vaughan and Donald I. McCane (Univ. of Michigan, Ann Arbor). J. Am. Chem. Soc. 76, 2504-5(1954) May 5.

A method for the preparation of CuCN with an over-all yield of 67 to 85% is outlined. (J.S.R.)

3989

BORON-NITROGEN SYSTEMS. III. BORON TRIFLUORIDE–DIAMINE ADDITION COMPOUNDS. Charles A. Brown, Earl L. Muetterties, and Eugene G. Rochow (Harvard Univ., Cambridge, Mass.). J. Am. Chem. Soc. 76, 2537-9(1954) May 5.

Ethylenediamine·$2BF_3$ and hexamethylenediamine·$2BF_3$ have been prepared and some of their physical and chemical properties determined. Hydrolysis and alcoholysis of these compounds indicate that the ethylenediamine compound is significantly more reactive than hexamethylenediamine·$2BF_3$. This behavior is attributed to a pronounced group interaction in the former compound. Ethylenediamine·BF_3 has also been prepared and some properties of this compound are given. (auth)

3990

FORMATION, STABILITY AND CRYSTAL STRUCTURE OF THE SOLID ALUMINUM SUBOXIDES: Al_2O AND AlO. Michael Hoch and Herrick L. Johnston (Ohio State Univ., Columbus). J. Am. Chem. Soc. 76, 2560-1(1954) May 5.

The study of the reactions (1) $4Al(1) + Al_2O_3(s) \rightarrow 3Al_2O(s)$ and (2) $Al(1) + Al_2O_3(s) \rightarrow 3AlO(s)$ between 1000 and 2000°, by means of a high temperature x-ray technique, indicated the formation of solid Al_2O and AlO above certain temperatures. At 1000° no reaction occurs. Between 1100 and 1500° $Al_2O(s)$ is formed according to reaction 1. Between 1500 and 1600°, both reactions 1 and 2 occur simultaneously, whereas above 1600° the latter reaction occurs. On cooling or rapid quenching both compounds disproportionate into Al and Al_2O_3. From the x-ray-diffraction patterns the crystal structure and lattice constants of Al_2O and AlO were determined. Both are cubic, the lattice constants being 4.98 A for Al_2O at 1110°, and 5.67 A for AlO at 1700°. (auth)

3991

OXIDATION OF HYDRAZINE IN SOLUTION. John W. Cahn and Richard E. Powell (Univ. of California, Berkeley). J. Am. Chem. Soc. 76, 2568-72(1954) May 5.

Non-equilibrium mixtures of ordinary hydrazine with hydrazine-N^{15} have been treated with a number of oxidizing agents, and the resulting N_2 has been analyzed by mass spectrometer. The N_2 arising from 4-electron oxidation is not isotopically randomized, but the N_2 from 1-electron oxidation is 50% randomized. The relative rates of 4-electron and 1-electron oxidation have been measured in the reaction of hydrazine with ferric ion. A reaction mechanism is proposed in which the first product of oxidation is a hydrazyl radical, which then suffers (a) further oxidation, (b) dismutation, or (c) dimerization. (auth)

3992

THE MAGNESIUM BROMIDE–LITHIUM BROMIDE–WATER SYSTEM. John R. Heiks and A. B. Garrett (Ohio State Univ., Columbus). J. Am. Chem. Soc. 76, 2587-90(1954) May 5.

The ternary system magnesium bromide–lithium bromide–water has been investigated by thermal analysis from +20° to the ternary eutectic. No double salts are formed over the temperature range investigated, but the di-, tri- and pentahydrates of lithium bromide and the hexa- and decahydrates of magnesium bromide are found. The ternary eutectic occurs at a temperature of −78° and at a composition of 59.2% (by weight) water, 29.5% (by weight) lithium bromide, and 11.3% (by weight) magnesium bromide. Isothermal sections were plotted at 0° and at −25°. The lithium bromide–water system which makes up one side of this ternary system has been investigated. A new hydrate of lithium bromide, existing at temperatures below −49°, was found. Evidence obtained indicates that this hydrate is probably the pentahydrate of lithium bromide. The eutectic point for this system was found to occur at a temperature of −67.5° and at a concentration of 39.3% (by weight) lithium bromide. The magnesium bromide–water system which makes up another side of

the ternary system has also been studied. The terminal data obtained for the system are in good agreement with earlier solubility data obtained by Getman. The eutectic point for this two-component system was found to occur at −44.0° and 36.8% (by weight) magnesium bromide. (auth)

3993

NON-EXCHANGE OF CHLORINE BETWEEN CHLORATE AND PERCHLORATE IONS. D. A. Lee (Oak Ridge National Lab., Tennessee). J. Am. Chem. Soc. 76, 2590-1(1954) May 5.

No exchange of Cl between chlorate and perchlorate ions in water solution at room temperature was noted in two years. There was no exchange in 0.1N H_2SO_4 and 0.1N NaOH in 19.5 hr and no effect was found by increasing the temperature to 99°. (J.S.R.)

3994

APPLICATION OF THE SORPTION METHOD TO THE INVESTIGATION OF THE INTERACTION OF ZIRCONIUM OXIDE WITH THE OXIDES OF CALCIUM AND MAGNESIUM. E. N. Nikitin. Doklady Akad. Nauk S.S.S.R. 94, 919-21(1954) Feb. 11. (In Russian).

Phase diagrams of the $CaO-ZrO_2$ and $MgO-ZrO_2$ systems were studied. The effects of preliminary heat treatments on the resulting solubility of the systems were determined. (J.S.R.)

3995

DIAGRAMS OF THE SOLUBILITIES OF THE TERNARY SYSTEMS LiCl− $CuCl_2-H_2O$ AND LiCl− $ZnCl_2-H_2O$. V. P. Blidin and V. I. Gordienko. Doklady Akad. Nauk S.S.S.R. 94, 1081-4(1954) Feb. 21. (In Russian).

The isotherms at 25°C of the systems LiCl− $CuCl_2-H_2O$ and LiCl− $ZnCl_2-H_2O$ were investigated, and phase diagrams are given. The method of investigation is described in detail. (J.S.R.)

3996

DIAGRAM OF THE FUSIBILITY OF THE SYSTEM Ni−Cr−NiAl. I. I. Kornilov and R. S. Mints. Doklady Akad. Nauk S.S.S.R. 94, 1085-8(1954) Feb. 21. (In Russian).

The fusibility diagram of the system Ni−Cu−NiAl was investigated by thermal analysis and a study of the microstructure. A phase diagram is given. (J.S.R.)

3997

ISOTOPIC EXCHANGE OF HYDROGEN IN HYDROCARBONS IN A LIQUID MEDIUM OF DEUTERIUM FLUORIDE. Ya. M. Varshavskii and A. I. Shatenshtein. Doklady Akad. Nauk S.S.S.R. 95, 297(1953) Mar. 11. (In Russian)

The mechanism of the rate of D exchange between D-enriched HF and hydrocarbons was investigated. D-enriched HF was produced by the isotopic exchange reaction of HF and heavy water. Isotopic exchange was measured between DF and the hydrocarbons benzene, toluene, anthracene, phenyl methyl ester, dimethylaniline, naphthaline, phenanthrene, diphenyl methane, triphenyl methane, chlorobenzene, tetraline, decalin, cyclohexane, methyclohexane, hexane, and heptane. The rate of exchange is explained by the probable generation of fluorine oxide during the preparation of D-enriched HF. (J.S.R.)

3998

ANODIC VOLTAMMETRY OF PHENOLS. John F. Hedenburg and Henry Freiser (Univ. of Pittsburgh, Penna.). Anal. Chem. 25, 1355-8(1953) Sept.

The applicability of anodic voltammetry to phenols, in the hope that a rapid quantitative method of phenol analysis could be developed, and the oxidation of phenols, with a view to developing a method for evaluation of phenols as antioxidants, were studied. It was found that phenol can be oxidized at a micro platinum anode, yielding a current-voltage curve similar to the conventional polarographic wave. A reproducible half-wave potential, shown to be a function of pH, is obtained. At pH 9, the half-wave potential has a value of 0.52 volt. An equation has been derived which closely describes the pH dependence of the half-wave potential. A plot of log $I/(I_d-I)$ vs. E gives a straight line, indicating a polarographically reversible one-electron oxidation to the phenoxide free radical. The diffusion current is found to be closely proportional to the concentration and essentially independent of the pH. This new method of analysis for phenols will also permit an electromotive series to be constructed for phenols and enols whose over-all oxidation is irreversible. (auth)

ANALYTICAL PROCEDURES

3999

Atomic Energy Research Establishment, Harwell, Berks (England)

A LOW PRESSURE METHOD FOR THE MICRO-DETERMINATION OF CARBON IN METALS. G. A. Barnett, J. N. Gregory, and D. Mapper. Jan. 21, 1954. 14p. (AERE-C/R-1315)

4000

Atomic Energy Research Establishment, Harwell, Berks (England)

A VOLUMETRIC PROCEDURE FOR THE DETERMINATION OF ZIRCONIUM IN ITS BINARY ALLOYS WITH URANIUM. G. W. C. Milner and P. J. Phennah. Feb. 8, 1954. 18p. (AERE-C/R-1354)

Zirconium was determined volumetrically by the addition of an excess of a standard solution of (ethylenediamine) tetraacetic acid to complex the zirconium followed by the back titration of unused complexing agent with a standard iron solution using salicylic acid as the indicator. Under these conditions, it is possible to determine up to at least 100 mg of zirconium to an accuracy of the order of ± 1%. This procedure is also applicable after the preliminary separation of zirconium from other elements with organic precipitants followed by resolution of the precipitate in hydrochloric or sulphuric acid. This titration has proved of advantage in the rapid analysis of uranium−zirconium binary alloys after the preliminary separation of the zirconium as its insoluble mandelate from a perchloric acid solution of the alloy. (auth)

4001

ON THE USE OF ION EXCHANGES FOR THE SEPARATION, CONCENTRATION AND DETERMINATION OF TRACES OF CADMIUM IN URANIUM. Zdenko Dizdar. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 2, 85-8(1953) Jan.

For the separation and concentration of cadmium traces present in uranium, in order to determine them quantitatively, the cation exchanger of the Amberlite IR-120 type may be used with 0.5N oxalic acid and 1N hydrochloric acid as eluting agents. The resulting effluents may be completely evaporated and the cadmium content in the deposits determined by one of the usual methods. The advantage of such a procedure lies in the possibility of increasing the degree of exactness of the cadmium determination, by the desired degree of cadmium concentration, i.e., by increasing the quantity of the solution to be passed through the column. (auth)

4002

CHROMATOGRAPHY AND ANALOGOUS DIFFERENTIAL MIGRATION METHODS. Harold H. Strain, T. R. Sato, and John Engelke (Argonne National Lab., Lemont, Ill.). Anal. Chem. 26, 90-100(1954) Jan.

Differential migration techniques applicable to chromatography and recent developments in the field of chromatographic separations are reviewed. 185 references. (C.H.)

4003

ANALYSIS OF BERYLLIUM CARBIDE. S. A. Reed, E. S. Funston, and W. L. Bridges (General Electric Company, Oak Ridge, Tenn.). Anal. Chim. Acta 10, 429-42(1954) May.

An analysis scheme is presented for determining the composition of impure beryllium carbide. The determination of combined (carbide) carbon, which fixes the amount of Be_2C present, is based on a catalytic oxidation of the methane formed by an acid hydrolysis of the carbide. The major impurities, beryllium oxide and free carbon, are readily determinable after separating the oxide by selective bromination of the carbide, and liberating the free carbon by a simple acid digestion. Analysis for fixed nitrogen is made by the Kjeldahl method and total moisture, which includes both adsorbed water and water of hydration, is obtained by drying samples in an inert gas stream at 700° C. An improved dibasic ammonium phosphate precipitation is used for determining beryllium. (auth)

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

4004

EXPERIMENT ON THE CONSTRUCTION OF A PERIODIC SYSTEM OF ATOMIC NUCLEI. M. L. Chepelevetskii. Zhur. Eksptl'. i Teoret. Fiz. 23, 327-35(1952) Sept. (In Russian)

For a foundation of a series of investigations of nuclear properties a periodic system of isotopes of atomic nuclei is given. The dimensions of the periods of the nuclei were determined by the number of neutrons and protons in the periods, and in the same way the connection between the forms of the periodicity was determined. The hypothesis states that the construction of a period is accomplished by means of finishing the construction with nucleons of surface layers of nuclei with subsequent finishing of its deep layers. (tr-auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4005

Livermore Research Lab., Calif. Research and Development Co.

A MODIFIED BRIDGMAN FURNACE FOR THE GROWING OF ZINC MONOCRYSTALS. J. R. Gaskill. Apr. 1954. 20p. Contract AT(11-1)-74. (LRL-126)

A simple and flexible furnace is described in which zinc monocrystals can be grown from samples of metal of analytical purity, encased in evacuated pointed Vycor tubes. Notes are made of the technique of growing such monocrystals. (auth)

FLUORINE AND FLUORINE COMPOUNDS

4006

THE POLAROGRAPHIC DETERMINATION OF FLUORIDE. PART I. BASIC PRINCIPLES OF THE METHOD: APPLICATION TO THE CATHODE-RAY POLAROGRAPH. B. J. Macnulty, G. F. Reynolds, and E. A. Terry (Chemical Inspectorate Station Approach Buildings, Kidbrooke, London, England). Analyst 79, 190-8(1954) Apr.

A sensitive method for determining fluoride polarographically based on the depression by fluoride of the polarographic step given by the reduction of the aluminum–Solochrome Violet R. S. complex is described. The step depression is shown to be linearly related to the amount of fluoride down to 0.001 μg/ml. The use of this method with the cathode-ray polarograph is described. (auth)

4007

ELECTRON AFFINITY OF FLUORINE. John L. Margrave (Univ. of Wisconsin, Madison). J. Chem. Phys. 22, 636-8 (1954) Apr.

Various theoretical and semi-empirical methods for determining electron affinities of atoms have been applied to fluorine. All results indicate a low value of the electron affinity consistent with recent experimental data, and with the value implied by the recently determined dissociation energy of the fluorine molecule. An extrapolation of the type suggested by Hellmann and Mamotenko appears to give the most reliable value and indicated $E_F = 83.2 \pm 0.3$ kcal/mole. (auth)

4008

RAMAN SPECTRA AND POTENTIAL CONSTANTS FOR CF_3Cl, CF_3Br, and CF_3I. Robert Cooper Taylor (Univ. of Michigan, Ann Arbor). J. Chem. Phys. 22, 714-16(1954) Apr.

Raman frequencies have been obtained for gaseous CF_3Cl and CF_3Br and for liquid CF_3I at −40°C. The assignments are in agreement with previous investigations. The spectra have been analyzed using a simplified six-constant potential function of the Urey-Bradley type without the assumption of tetrahedral angles around the central carbon atom. In all three cases it was found possible to reproduce the experimental frequencies to within less than their experimental error. (auth)

4009

THE REACTION BETWEEN FLUORINE AND CHLORINE DIOXIDE, A HOMOGENEOUS, BIMOLECULAR REACTION. P. J. Aymonino, J. E. Sicre, and H. J. Schumacher (Univ. Nacional de Eva Perón, Argentina). J. Chem. Phys. 22, 756-7(1954) Apr.

The reaction between F_2 and ClO_2 from −46 to −26°C and approximately 50 to 500 torr is reported. The heat of activation of the reaction was calculated, and the steric factor is given. (J.A.G.)

LABORATORIES AND EQUIPMENT

4010

Knolls Atomic Power Lab.

COLLECTION EFFICIENCY OF AIR-CLEANING AND AIR-SAMPLING FILTER MEDIA. J. J. Fitzgerald and C. G. Detwiler. Mar. 15, 1954. 55p. Contract W-31-109-eng-52. (KAPL-1088)

The collection efficiency of several air-cleaning and air-sampling filter media was studied at face velocities of 0.5 to 250 cm/sec. The Millipore Filters used to test the filter media were analyzed under both the light and the electron microscope. Collection efficiency was expressed as a function of particle size and face velocity. Solid duraluminum particles with a density of 2.7 g/cm^3 were used as the test material to determine the collection efficiency of the Whatman-40 and 41, the Hollingsworth and Vose H-70, the AEC-1, the CC-6, and the AAA-1106-B filter media. The collection efficiency of these filter media was investigated for particles in the size range of 0.18 to 2.1 microns by a light microscope analysis. Atmospheric dust was used as the test material for the efficiency studies in the particle size range from 0.005 to 0.2 micron. A silica replication of Millipore Filter medium was made to prepare the test air samples for analyses under the electron microscope. This replication method minimizes the opportunity of forming agglomerates during the process of preparing the Millipore Filters for an electron microscope analysis. (auth)

RADIATION CHEMISTRY

4011

OXIDATION OF AQUEOUS FERROUS SULFATE SOLUTIONS BY CHARGED PARTICLE RADIATIONS. William R. McDonell and Edwin J. Hart (Argonne National Lab.,

Lemont, Ill.). J. Am. Chem. Soc. 76, 2121-4(1954) Apr. 20.

Chemical yields are reported for the oxidation of aqueous ferrous sulfate solutions by H^3 β particles, Po^{210} α particles, and by the recoil products of the $B^{10}(n,\alpha)Li^7$ and $Li^6(n,\alpha)H^3$ nuclear reactions. Yields for the heavy-particle radiation are considerably lower than for the β particles and decrease with decreasing energy. (auth)

4012

PHOTOLYSIS AND RADIOLYSIS OF LIQUID ALKYL IODIDES. Edward L. Cochran, William H. Hamill, and Russell R. Williams, Jr. (Univ. of Notre Dame, Ind.). J. Am. Chem. Soc. 76, 2145-8(1954) Apr. 20.

Several simple alkyl iodides have been irradiated as pure liquids with light of wave lengths 2537 and 3260 A, and with 50 kvp x-rays. Relative rates of iodine production have been measured and a correlation between these rates and molecular structure has been tested. Complex formation between iodine and alkyl iodide has been shown to influence the observed rate of iodine production at 3260 A, but not at 2537 A. Dilute solutions of alkyl iodides in hydrocarbons have also been photolyzed at 2537 A, and several evidences of distinction between the reactions in solution and the pure state have been obtained. (auth)

RADIATION EFFECTS

4013

Chemical Research Lab., Metal Hydrides, Inc.
GAMMA RAY SENSITIVE ALKALI HALIDE CRYSTALS. INTERIM DEVELOPMENT REPORT NO. 14 [FOR] JULY 24–AUGUST 24, 1952. M. D. Banus. Aug. 29, 1952. 15p. Contract NObsr-52428. (AD-11802; R-7027)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4014

A STUDY OF THE EXTRACTION OF EUROPIUM NITRATE TRACES USING RADIOACTIVE Eu^{152} AS INDICATOR. Ivan Draganić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 2, 73-5(1953) Jan.

Distribution coefficients of europium nitrate in the Et_2O–HNO_3 system were examined for various acid concentration and temperatures. The concentration of europium was about 18×10^{-6} g/ml in HNO_3 phase. The Eu^{152} was applied as radioactive indicator (0.5 μc/ml in the HNO_3 phase), and the distribution coefficient is given as the ratio of radioactive intensities (imp/min/ml) in both phases. The values obtained increased from 1.2×10^{-5} to 1.6×10^{-3} with the increase of the concentration of nitric acid from 1 to 10 M and from 0.8×10^{-4} to 4.2×10^{-4} with the increase of temperature from 13.5 to 27°C. (auth)

4015

A SPECTROPHOTOMETRIC INVESTIGATION OF THE CERIUM(IV)–CHROMIUM(VI) COMPLEX ION EQUILIBRIA IN PERCHLORIC ACID SOLUTIONS. James Ying-Peh Tong and Edward L. King (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 76, 2132-5(1954) Apr. 20.

Spectrophotometric measurements upon 1.00M perchloric acid solutions containing cerium(IV) and chromium(VI) at 25° demonstrate the existence of a complex ion involving one cerium(IV) atom and one chromium(VI) atom. Since the measurements were made at this one acidity only, it was not possible to establish the net charge upon the complex. The value of the apparent equilibrium quotient K has been obtained from the spectral data. If the 1 : 1 complex ion has the formula $CeCrO_4^{++}$, the value of the equilibrium quotient $(CeCrO_4^{++})/(Ce^{+4})(CrO_4^{=})$ may be calculated from the value of K. The value, so obtained, is larger than the value of the corresponding equilibrium quotient for the $CeSO_4^{++}$ complex ion by a factor of approximately 10^7. (auth)

4016

INFLUENCE OF PERCHLORIC ACID AND CEROUS PERCHLORATE UPON THE PHOTOCHEMICAL OXIDATION OF CEROUS TO CERIC PERCHLORATE IN DILUTE AQUEOUS PERCHLORIC ACID. Lawrence J. Heidt and Alan F. McMillan (Mass. Inst. of Technology, Cambridge). J. Am. Chem. Soc. 76, 2135-9(1954) Apr. 20.

The quantum yield of the photochemical oxidation of cerous to ceric perchlorate in water by light absorbed by the cerous species has been found to be increased when either the concentration of perchloric acid or cerous perchlorate or both have been increased. The reciprocal of the yield depends linearly upon the reciprocal of either of these concentrations when other variables are held constant. A small linear extrapolation of these relationships reveals that the maximum possible quantum yield of the reaction in this system at 25° with light of 2537 A is 0.0014 mole of cerous converted to ceric ions, equivalent to the production of 0.0007 mole hydrogen gas, per mole of light quanta absorbed by the cerous state. A set of reactions has been found which is in quantitative agreement with the data. This set is not necessarily a unique solution to the problem but it is a simple and reasonable solution; simple alternative reactions have been evaluated. Some new evidence has been obtained confirming the production of hydrogen by the light absorbed by the cerous ions. The key intermediate in the reaction appears to be the ion $(H_2O)_5Ce{-}OH{-}H_2^{+4}$ which reacts with hydrated cerous ions to produce ceric ions and hydrogen. An estimate of the oxidizing power of the hydrogen molecule ion in water shows that its standard oxidizing potential is at least 2.3 v with respect to reduction to hydrogen compared to about 1.7 v for ceric reduced to cerous ion so it is not surprising that cerous ions are oxidized to ceric ions in the above reaction. (auth)

4017

THE CHELATION OF PRASEODYMIUM BY THENOLYTRIFLUOROACETONE. T. K. Keenan and J. F. Suttle (Univ. of New Mexico, Albuquerque). J. Am. Chem. Soc. 76, 2184-5(1954) Apr. 20.

The extent of chelation of Pr in a system consisting of an aqueous phase and a benzene-thenoyltrifluoroacetone phase was measured as a function of pH. A table shows the ratio $[PT_3]$ $[Pr^{+3}]$ and the over-all equilibrium constant involved in the distribution of Pr between the two phases for pH's from 3.00 to 4.21. (A. G. W.)

SEPARATION PROCEDURES

4018

Radiation Lab., Univ. of Calif., Berkeley
EXTRACTION OF ZIRCONIUM AND HAFNIUM WITH VARIOUS FLUORINATED β-DIKETONES. E. H. Huffman, G. M. Iddings, R. N. Osborne, and G. V. Shalimoff. Apr. 5, 1954. 15p. Contract W-7405-eng-48. (UCRL-2536)

The distribution ratios and equilibrium constants for the extraction of zirconium and hafnium from 4M perchloric acid with various combinations of fluorinated β-diketones and organic solvents have been determined. The separation factors, K'_{Zr}/K'_{Hf}, found for this acidity were: 2-thenoyltrifluoroacetone in benzene, 25; 2-thenoyltrifluoroacetone in o-dichlorobenzene, 16; benzoyltrifluoroacetone in benzene, 18; isovaleroyltrifluoroacetone in benzene, 13; isovaleroyltrifluoroacetone in hexane, 13. (auth)

4019

PREPARATION AND ISOLATION OF CARRIER-FREE As^{74} FROM GERMANIUM CYCLOTRON TARGETS. Mino Green and James A. Kafalas (Mass. Inst. of Tech., Cambridge). J. Chem. Phys. 22, 760(1954) Apr.

The bombardment of Ge with 16-Mev deuterons gave As^{74} by the reaction $_{32}Ge^{73}(d,n)\ _{33}As^{74}$. The only other long-lived species was As^{73}, and this was too weak for detection. The Ge target was processed 2 weeks after irradiation when nearly all the activity is due to As^{74}, the Ge being extracted from an 11N HCl and As^{74} solution by benzene. The recovery efficiency obtained was 95 ± 5%, and the measured half life of the isolated activity was 17.5 days. (J.A.G.)

4020

SEPARATION OF TRACES OF THE RARE EARTH ELEMENTS FROM URANIUM BY MEANS OF AMBERLITE IR-120 RESIN. Daro Dolar and Zorica Draganić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 2, 77-83(1953) Jan.

In order to find a specific elution agent for the separation of rare earths from uranium, the following solutions in different concentrations were examined: hydrochloric, sulphuric, oxalic, citric, and tartaric acid and also ammonium citrate, ammonium oxalate, and ammonium tartrate. The elution curves for uranium, cerium, and europium are given. The following procedure for the rare earth separation was adopted: after the absorption in the column, the first to be eluted was uranium by means of 1N oxalic acid, and then the rare earth with 5N HCl. The efficiency of such a separation is shown. The errors are below ± 5%. (auth)

4021

DISTRIBUTION OF ZIRCONIUM AND HAFNIUM BETWEEN CATION-EXCHANGE RESIN AND ACID SOLUTIONS. THE COLUMN SEPARATION WITH NITRIC ACID–CITRIC ACID MIXTURE. Joseph T. Benedict, Walter C. Schumb, and Charles D. Coryell (Mass. Inst. of Tech., Cambridge). J. Am. Chem. Soc. 76, 2036-40(1954) Apr. 20.

A survey has been made, using radioactive tracers, of the distribution of zirconium and hafnium between solutions containing varying concentrations of sulfuric, hydrochloric, or nitric acids and the cation-exchange resin Dowex-50. Since the differences in behavior of the two elements were not great, attention was also given to the effects of varying concentrations of oxalic, tartaric, and citric acids in nitric acid. These data cast light on the chemical behavior of the elements in acid solution. A gross difference in the distribution coefficient in a solution 0.45M in nitric acid and 0.09M in citric acid was exploited by using this solution as elutriant for the elements from an ion-exchange column; the column separation was very effective in removing the zirconium from the more slowly eluted hafnium. (auth)

SPECTROSCOPY

4022

USE OF ALTERNATING CURRENT ARC WITH MAGNETIC EXTINCTION AS LIGHT SOURCE IN SPECTROANALYSIS. P. F. Lokhov. Translated from Zavodskaya Lab. 13, 628-30 (1947). 6p. Available from Henry Brutcher (Trans. No. 2512), Altadena, Calif. (AEC-tr-1898)

4023

THE ARGONNE THIRTY-FOOT SPECTROGRAPH. F. S. Tomkins and M. Fred (Argonne National Lab., Lemont, Ill.). Spectrochim. Acta 6, 139-43(1954) Feb.

The new Argonne spectroscopy laboratory includes a thirty-foot Paschen-Runge mounting, utilizing either plates or photocells. Construction details are presented of noteworthy items, e.g., the interchangeable fixed slits, grating holders, and source optical benches. For photoelectric detection the exit slit assembly is pulled along the continuous plate rail by a selsyn drive. Optimum masking of the grating was established by scanning Hg^{198} lines. Typical spectra are reproduced. (auth)

SYNTHESES

4024

National Bureau of Standards

FLUORINE SUBSTITUTION IN HYDROUS SILICATES AND RELATED MINERALS. [QUARTERLY REPORT FOR PERIOD ENDING MARCH 31, 1954]. A. Van Valkenburg and G. F. Rynders. Mar. 1954. 24p. Contract NAonr-132-52. (NBS-3289)

4025

South Carolina Univ.

[INVESTIGATION OF THE MECHANISM OF ALLYLIC FLUORINATION]. FINAL REPORT. H. W. Davis. Apr. 21, 1954. 28p. Contract AT-(40-1)-1306. (ORO-122)

The mechanism of the first stage of allylic fluorination by the use of C^{14}-labeled hexachloropropene and the exchange of acyl groups using C^{14}-labeled materials are discussed. Hexachloropropene-1-C^{14} was prepared from $C_6H_5COC^{14}H_3$ and fluorinated by heating with SbF_3 and catalytic amounts of $SbCl_5$. Ozonolysis of both hexachloro- and trifluorotrichloropropene is discussed. Trichloroacrylic acid was prepared from C^{14}-labeled hexachloropropene. (J.A.G.)

4026

THE RASCHIG SYNTHESIS OF HYDRAZINE. John W. Cahn and Richard E. Powell (Univ. of California, Berkeley). J. Am. Chem. Soc. 76, 2565-7(1954) May 5.

It has been possible to fit existing yield data for the Raschig synthesis by assuming simple rate laws. Hydrazine is formed by a bimolecular reaction between ammonia and chloramine and destroyed by a bimolecular reaction between hydrazine and chloramine. The latter reaction rate constant is about 18 times that of the former reaction, and therefore large excesses of ammonia are needed to make the first reaction predominate. The role of copper can be explained by assuming that copper catalyzes the destruction of hydrazine, again as a bimolecular reaction involving copper and hydrazine. In terms of these mechanisms the role of gelatin in increasing yield is that of complexing copper. This copper complex of gelatin appears to be unstable below pH 11. (auth)

4027

THE PREPARATION OF HYDRAZINE FROM UREA AND t-BUTYL HYPOCHLORITE. Ervin Colton, Mark M. Jones and L. F. Audrieth (Univ. of Illinois, Urbana). J. Am. Chem. Soc. 76, 2572-4(1954) May 5.

The use of t-butyl hypochlorite as an oxidizing agent and as an N-chlorinating agent has been extended to urea. It has been demonstrated that t-butyl hypochlorite and urea react in alkaline solution to form hydrazine. The yield of hydrazine is dependent upon (a) the mole ratio of urea to t-butyl hypochlorite, (b) the presence of alkali, and (c) the use of an inhibitor such as gelatin. Experimental conditions are similar to those which have been found previously to govern the formation of hydrazine from t-butyl hypochlorite and ammonia. It has been shown spectrophotometrically that N-chlorourea is the initial product of reaction between urea and t-butyl hypochlorite. (auth)

URANIUM AND URANIUM COMPOUNDS

4028

THE USE OF SODIUM FLUORIDE AS CARRIER IN THE SPECTROGRAPHIC DETERMINATION OF CADMIUM AND BORON IN URANIUM. Natalija Belegišanin. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 2, 27-30(1953) Jan.

The Scribner and Mullin method of spectrographic determination of impurities in uranium by the carrier distillation procedure has been modified by using NaF as the carrier material, and it is possible to determine qualitatively and quantitatively Cd and B present in

uranium. The use of NaF instead of Ga_2O_3 and the use of simple electrodes facilitate to an appreciable degree the application of this spectrographic method and extend its field of application. (auth)

4029

PREPARATION OF URANIUM TETRAFLUORIDE BY PHOTOSYNTHESIS. Ivan Gal. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 2, 61-71(1953) Jan.

Bolton's photosynthesis of K_2UF_6 by the reduction of uranyl ions in the presence of formic acid under the influence of sunlight is discussed. A method for the photochemical preparation of UF_4 is proposed, based on the reaction $UO_2(NO_3)_2 + C_2H_5OH + 4HF = UF_4 + 2HNO_3 + C_2H_4O + 2H_2O$. Optimum conditions for UF_4 photosynthesis are discussed. (LT.W.)

4030

DEPENDENCE OF THE RATIO O/U IN URANIUM DIOXIDE ON THE REDUCTION TEMPERATURE OF UO_3. Milenko Šušić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 2, 89-92(1953) Jan.

Uranium trioxide obtained at 350°C from uranyl nitrate can be successfully reduced by hydrogen to UO_x, where the values of x is greater than 2.00, and for higher temperatures is very close to 2.00. The relation $O/U = x$, and the yield of tetravalent uranium (U–IV), does not depend in a marked degree on the temperature of reduction of UO_3, for the temperature range from 450 to 750°C. The solubility of UO_x, obtained at the corresponding temperatures, in HF is practically the same. The uranium tetrafluoride coagulates easily on dilution of the solution and can be filtered, dried, and used for obtaining uranium metal. The experiments have shown that UO_x obtained at different temperatures gives the quantity of uranium tetrafluoride which corresponds to the tetravalent uranium in UO_x. (auth)

4031

ABSORPTION SPECTRA AND ELECTRICAL CONDUCTIVITIES OF UO_2–ThO_2 SOLID SOLUTIONS. Dieter M. Gruen (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 76, 2117-20(1954) Apr. 20.

The absorption spectra of UO_2–ThO_2 solutions between 4500 and 7000 A show four discrete bands with maxima at 5100, 5400, 6000, and 6500 A which are attributed to electronic transitions between various states of the U^{+4} ion. In addition, an intense, continuous absorption band is found whose long wave length edge shifts to shorter wave lengths with decreasing uranium concentration. This band is attributed to resonance of uranium ions between different oxidation states. Electrical conductivities of pressed UO_2–ThO_2 discs were measured for the temperature interval 300 to 450°K and were found to decrease by a factor of 10^6 in the concentration range 100 to 10% uranium. The activation energy for conductivity changed from 0.20 ev for pure UO_2 to 0.37 ev for 10% UO_2–90% ThO_2 solid solution. An attempt has been made to correlate changes in the optical and electrical properties with nearest neighbor interactions involving uranium ions in different oxidation states. (auth)

4032

ANALYTICAL APPLICATIONS OF THERMOGRAVIMETRY. II. ON URANYL PERIODATES. F. Burriel Martí and C. Barcia Goyanes (Facultad de Ciencias, Madrid). Anales real soc. españ. fis. y quim. (Madrid). Ser. B. 50, 281-4 (1954) Mar. (In Spanish)

The preparation and identification of a new compound, a KUO_2 mesoperiodate, by thermogravimetric procedures is described. U can be determined by the thermogravimetric curves or iodometric titrations. (J.S.R.)

WASTE DISPOSAL

4033

Brookhaven National Lab.

THE OCCURRENCE AND CONTROL OF RADIOACTIVE ENTRAINMENT IN EVAPORATIVE SYSTEMS. B. Manowitz, R. H. Bretton, and R. V. Horrigan. Oct. 1953. 27p. (BNL-1639)

A study has been made of entrainment generation in a submerged coil evaporator and a vertical-tube natural circulation evaporator. Both evaporators generated about the same amount of entrainment at comparable boil-up rates. The decontamination efficiency of a submerged coil evaporator is correlated to the boil-up rate. The efficiency of a bubble-cap column, a Raschig ring packed tower, and a glass wool-packed tower as de-entrainment devices was studied, the glass wool-packed tower proving to be the most effective. (auth)

ENGINEERING

4034

Knolls Atomic Power Lab.

THERMAL STRESSES IN RECTANGULAR STRIPS. [PART] 2. J. S. Born, and G. Horvay. [1954]. 27p. Contract W-31-109-Eng-52. (AECU-2869)

Stresses and deformations in rectangular strips due to various longitudinal temperature distributions are presented in formulas, tables and graphs. The results are important for slabs, plate assemblies, rectangular ducts; tube sheet ligaments, and various other structures. (cf. NSA 8-1883), (auth)

HEAT TRANSFER AND FLUID FLOW

4035

Harvard Univ.

SOME PRACTICAL METHODS OF USING CHARACTERISTICS IN THE CALCULATION OF NON-STEADY COMPRESSIBLE FLOW. Douglas R. Hartree. Sept. 1953. 44p. Contract W-7405-eng-36, Subcontract SC-7. (AECU-2713)

Three methods of using characteristics for the evaluation of solutions of equations of nonsteady isentropic compressible flow in one-space variable are considered and compared. One involves the use of a grid of characteristics, in terms of Eulerian variables; two others involve use of the properties of characteristics to relate the flow at the beginning and end of a given time interval but do not involve the use of a grid of characteristics. One of these uses Eulerian variables, and the other Lagrangian variables. The arithmetical process of solution is appreciably simpler for the equations in terms of Eulerian variables rather than in terms of Lagrangian variables. Also, use of specified time intervals seems to have several advantages over the use of a grid of characteristics, in simplifying the numerical process, in providing results in the form most likely to be required, namely, the flow field at different times, and in other ways. Hence, the use of specified time intervals, in Eulerian variables, is chosen as the method to develop further. The extension to anisentropic flow is found to be numerically simple and straightforward, and the treatment of a shock appears surprisingly simple. Some tentative suggestions are made of methods for evaluating unsteady flow in two-space dimensions, retaining as much as possible the advantages of the use of characteristics in unsteady flow in one-space dimension. (auth)

4036
Argonne National Lab.
LOCAL BOILING PRESSURE DROP. J. B. Reynolds. Mar. 1954. 44p. Contract W-31-109-eng-38. (ANL-5178)

Local boiling pressure drop data for forced circulation of distilled water in a uniformly heated, horizontal, Type 347 stainless steel tube (3/8 in. ID × 1/2 in. OD × 6 ft long) is correlated within ± 20% over the following range of variables: heat fluxes from 130,000 to 304,000 Btu/(hr) (sq ft); mass velocities from 343 to 652 lb/(sec) (sq ft) (corresponding to inlet water velocities of 7 to 10.6 fps); and pressures from 45 to 100 psia. Graphical comparison of local boiling pressure drop to isothermal pressure drop shows a maximum ratio of approximately 2.6. (auth)

4037
Nuclear Development Associates, Inc.
TURBULENT HEAT TRANSFER IN POLYGONAL FLOW SECTIONS. (Supplement to NDA-10-7). H. G. Elrod, Jr. [June 30, 1953] 11p. (NDA-10-86)

In report NDA-10-7 the peripheral shear stresses in polygonal flow sections were studied to obtain background information for the heat transfer occurring with the same flow geometry. A mathematical approximation of uncertain error was used. In the present report a systematic numerical method for accomplishing the analysis is described, and its results are compared with those obtained earlier. (L.T.W.)

4038
Mine Safety Appliances Co.
HEAT TRANSFER WITH SODIUM–POTASSIUM LIQUID ALLOYS. Robert C. Werner, Earle C. King, and Robert A. Tidball. Dec. 5, 1949. 45p. (NP-5169)

Over-all heat-transfer coefficients of 1000 to 2100 Btu/(hr) (ft^2) (°F) were measured in a double-pipe heat exchanger using a 44 and a 77 wt. % K alloy of sodium and potassium. The data cover a temperature range of 300 to 1200°F and a velocity range of 1.5 to 12 fps in the center tube. A method is presented for separating the over-all coefficients into individual film coefficients. The coefficients calculated by this method, with the aid of the physical properties of sodium–potassium alloys presented, are then compared with the theoretical coefficients for liquids of low Prandtl number with very favorable results. Values of the individual film heat-transfer coefficients are found to vary from 2000 to 6000 Btu/(hr) (ft^2) (°F) for the temperatures and velocities used. At temperatures up to about 1400°F, alloys of sodium and potassium will serve as excellent heat-transfer media because of their low vapor pressures, low viscosities, high thermal stability, high thermal conductivities, and melting points below room temperature. (auth)

4039
TRANSLATORY MOTION OF BODIES BELOW THE FREE SURFACE OF A HEAVY FLUID OF FINITE DEPTH. M. D. Khaskind. Translated by E. R. Hope from Appl. Math. Mech. Leningr. 9, 67-78(1945). 18p. (AEC-tr-1894)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

4040
Massachusetts Inst. of Tech.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS. QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING APRIL 1, 1954. F. H. Norton, W. D. Kingery, et al. Apr. 1, 1954. 8p. Contract AT(30-1)-960. (NYO-6442)

Measurement and calculation of thermal conductivity was continued with the determination of conductivity of some MgO–NiO solid solutions. A more comprehensive analysis of the temperature variation of thermal conductivity of single-phase materials has been completed. A number of factors have been found which may alter the general temperature dependence from the simplest theoretical predictions. An investigation of the conductivity of powders and fibers at elevated temperatures was commenced. (For preceding period see NYO-6441.) (auth)

GEOLOGY AND MINERALOGY

4041
Minnesota Univ.
ANNUAL REPORT FOR APRIL 1, 1953 TO MARCH 31, 1954. John W. Gruner, Abraham Rosenzweig, and Deane K. Smith, Jr. Apr. 1, 1954. 37p. Contract AT(30-1)-610. (RME-3094)

An experimental study which attempts to explain why so many of the red shales and silts of the Permian, Triassic, and Jurassic change to gray rocks in and near U deposits is described. Four possible chemical and crystal structural processes are suggested. The mineralogy of the Mi Vida mine is discussed. More evidence is presented that uraninite can form at very low temperatures, even at that of the laboratory. It is suggested that all U ores as originally deposited in the sediments were reduced by organic matter and associated sulfide, perhaps H_2S. A unique deposit of sulfates, including a new K Fe sulfate, at the Dexter claims of the Calf Mesa of the San Rafael Swell, Utah, is described. (For preceding period see RME-3044.) (J.S.R.)

4042
Geological Survey
RADIOACTIVITY OF COAL AND ASSOCIATED ROCK IN THE COAL FIELDS OF EASTERN KENTUCKY AND SOUTHERN WEST VIRGINIA. Stewart W. Welch. June 1953. 38p. (TEI-347A)

A reconnaissance study was made of radioactivity of coal and associated rock in the coal fields of eastern Kentucky and Logan and Mingo counties, W. Va. Sixty-one localities were visited and 98 samples, 90 of coal and two each of carbonaceous shale, marine shale, flint clay, and dike rock, were collected. Radioactivity of the samples was measured with portable assay equipment prior to being shipped to the Trace Elements Laboratory in Washington, D. C. for final determinations of radioactivity. The results showed the coal to have little or no radioactivity (0.000 to 0.001% equivalent uranium) and other rock sampled to have slight radioactivity (about 0.002% equivalent uranium). (auth)

4043
THORIUM DETERMINATION IN DEEP-SEA SEDIMENTS. E. Picciotto and S. Wilgain (Univ. Libre de Bruxelles, Belgium). Nature 173, 632-3(1954) Apr. 3.

Determination of Th^{227}, Th^{228}, Th^{230}, and Th^{232} in deep-sea sediments by a photographic method is discussed. Concentration of Th was calculated in samples of red clay from the Pacific Ocean from 5-branched star production, assuming Th to be in equilibrium with Th^{227} and ascribing all the 5-branched stars to Th^{227}. The chronology of deep-sea sediments by ionium-Th ratios is also discussed. (J.A.G.)

4044
GEOLOGY OF THE BULL CANYON QUADRANGLE, COLORADO. Fred W. Cater, Jr. Scale 1:24,000, 4p., 20 × 61 cm. Geologic Quadrangle Maps of the United States, Geological Survey, Washington, D. C., 1954.

The stratigraphy, structure, and mineral deposits of the Bull Canyon Quadrangle, Colo., are described, and a detailed map is given. (J.S.R.)

METALS AND METALLURGY

4045

Minerals Research Lab., Inst. of Engineering Research, Univ. of Calif., Berkeley.
QUANTITATIVE SUBSTRUCTURE AND TENSILE PROPERTY INVESTIGATIONS OF NICKEL ALLOYS. B. Ancker, E. R. Parker, and T. H. Hazlett. Apr. 1954. 39p. Contract AT-11-1-GEN-10, Technical Report No. 14. (AECU-2870)

Quantitative data on the substructure of Ni–Ti and Co–Ni alloys and high-purity Ni were obtained by x-ray techniques and were correlated with the strength of the metals. Results indicate that increasing amounts of deformation followed by recovery caused regular gain in the strength due to annihilation of internal barriers to slip. Small-angle boundaries introduced by room-temperature deformation became sharper during recovery, thus becoming much more effective in hardening the metal. The strength of the annealed alloys increased linearly with increasing alloy content. The substructure density of the alloys rose with increasing Ti content but approached a maximum with increasing quantities of Co. An increase in amount of room-temperature deformation caused a linear increase of small-angle boundary density for Ni and Ni–Ti alloys, but the substructure density again approached a maximum for Co alloys. The number of small-angle boundaries developed by room-temperature deformation is substantially unchanged by heating up to 800°C, but the subboundaries became sharper. Dislocation density increased without a corresponding increase in substructure density on Ni–Co alloys due to immobilization of the extended dislocations by a Co atom atmosphere even at high temperatures. Since the Ti atom is nearly 0.20 larger than the Ni atom, the Cottrell hardening mechanism may be operative in the Ni–Ti alloys. This would cause the Ti atmosphere to be relatively ineffective in altering the recovery process since both the pure Ni and the Ti alloys behaved the same during recovery. (J.A.G.)

4046

Cryogenic Lab., Ohio State Univ.
THERMAL, STRUCTURAL, ELECTRICAL, MAGNETIC, AND OTHER PHYSICAL PROPERTIES OF TITANIUM, ZIRCONIUM, HAFNIUM AND THORIUM, AND SOME OF THEIR SIMPLE COMPOUNDS. PART 4. THORIUM, ITS HYDRIDES, OXIDES, HALIDES, NITRIDE, CARBIDES AND THE ALKALINE EARTH THORATES. G. B. Skinner, C. W. Beckett, and H. L. Johnston. Feb. 1, 1950. 52p. Contract W-33-038-ac-17721, Technical Report No. 102-AC49/2-100-4. (ATI-81813)

(For preceding report in series see ATI-81814.)

4047

Cryogenic Lab., Ohio State Univ.
THERMAL, STRUCTURAL, ELECTRICAL, MAGNETIC AND OTHER PHYSICAL PROPERTIES OF TITANIUM, ZIRCONIUM, HAFNIUM AND THORIUM AND SOME OF THEIR SIMPLE COMPOUNDS. PART 3 HAFNIUM, ITS OXIDES, HALIDES, CARBIDE, AND THE ALKALINE EARTH HAFNATES. G. B. Skinner, C. W. Beckett, and H. L. Johnston. Feb. 1, 1950. 23p. Contract W33-038-ac-17721, Technical Report No. 102-AC49/2-100-3. (ATI-81814)

4048

Cryogenic Lab., Ohio State Univ.
THERMAL, STRUCTURAL, ELECTRICAL, MAGNETIC AND OTHER PHYSICAL PROPERTIES OF THE GROUP V ELEMENTS: TANTALUM, NIOBIUM(COLUMBIUM) AND VANADIUM. Esther Richert, C. W. Beckett, and H. L. Johnston. Dec. 1, 1949. 59p. Contract W33-038-ac-17721, Technical Report No. 102-AC49/11-100. (ATI-81819)

4049

Rensselaer Polytechnic Inst.
A STUDY OF THE WELD HEAT-AFFECTED ZONES IN ½-INCH TITANIUM ALLOY PLATES. FINAL SUMMARY TECHNICAL REPORT. Ernest F. Nippes, John M. Gerken, and Bernard W. Schaaf. Apr. 1954. 76p. Contract DA-30-115-ORD-42. (NP-5156)

In order to study the effects of the major welding variables on the notch toughness of the weld heat-affected zone of two titanium alloys, impact specimens of these alloys were synthetically heat treated to simulate the actual weld thermal cycles. The variables considered were energy input, initial plate temperature, post-heat temperature, and thermal cycle peak temperature. From Charpy V-notch impact tests it was learned that decreasing the weld cooling rate by increasing the energy input or by using a preheat resulted in generally higher impact strength in the weld heat-affected zone. There was only a small variation in impact strength with thermal-cycle peak temperature in cases where betanization was complete during heating. In the peak-temperature range of incomplete betanization during heating, the impact strength decreased with increasing peak temperature. A post-heat treatment of 1200 to 1250°F for 4 hr followed by a water quench was found to result in a substantial improvement in impact strength for the least tough structures in each alloy for thermal cycles based on an energy input of 35 kilojoules per inch with no preheat. Continuous-cooling transformation studies indicated that the microstructures obtained depended on the cooling rate just below the equilibrium transformation temperature and the degree of betanization. In the cooling-rate range normally found adjacent to welds, the transformation-temperatue range was almost constant, being slightly lowered with increasing cooling rates. (auth)

4050

Minerals Research Lab., Inst. of Engineering Research, Univ. of Calif., Berkeley
FUNDAMENTAL STUDIES RELATED TO THE ORIGIN AND NATURE OF CREEP OF METALS. TECHNICAL REPORT NO. 10. STRAIN HARDENING OF LATENT SLIP SYSTEM IN ZINC CRYSTALS. Eugene H. Edwards, Jack Washburn, and Earl R. Parker. Apr. 1954. 18p. Contract N7-onr-29516. (NP-5158)

4051

Pittsburgh Univ.
APPLICATION OF CHEMICAL THERMODYNAMICS TO THE STUDY OF ALLOY FORMATION. PROGRESS REPORT FOR JANUARY 1, 1954 TO APRIL 1, 1954. R. S. Craig, T. D. Brotherton, W. V. Johnston, S. Kamath, and C. A. Krier. Apr. 9, 1954. 8p. Contract AT(30-1)-647. (NYO-6320)

Calibration measurements have been completed on the equipment for measuring specific heats of potassium and Na_2K between 10 and 325°K. A sample of pure potassium has been prepared by triple distillation. Calibration measurements are in progress on the high-temperature adiabatic specific heat calorimeter (range 25 to 300°C). Equipment is being set up for a resistometric study of certain transitions in the magnesium–cadmium alloy system in the 200 to 300°K range. An x-ray-diffraction camera has been modified for operation in this temperature range. (For preceding period see NYO-6165.) (auth)

4052

Sylvania Electric Products, Inc., Atomic Energy Div.
SELF-DIFFUSION OF METALS AND ASSOCIATED

PHENOMENA. PART 10. PROGRESS REPORT [FOR] APRIL 1, 1953 TO OCTOBER 1, 1953. R. W. Balluffi, F. D. Rosi, and L. L. Seigle. Apr. 5, 1954. 6p. Contract AT-30-1-GEN-367. (SEP-152)

Investigations of porosity formation in dezincified α brass have revealed that grain boundaries preferentially absorb lattice vacancies and thus prevent the nucleation of porosity in their vicinity. Mathematical analysis indicates that the region of porosity formation in a diffusion couple is not necessarily bounded by the original marked interface but may occur anywhere in the diffusion zone. Observations have been made of volume changes and polygonization during diffusion in β brass, proving that the Kirkendall effect exists in this body-centered-cubic lattice. Attempts are being made to study material transport during sintering by following the motion of inert markers buried in copper wire spools. Appropriate specimens have been prepared. Further investigations have been made of the effect of temperature on the plastic properties of single crystals of silver, copper, and copper–aluminum alloys. (For preceding period see SEP-151.) (auth)

4053

Sylvania Electric Products, Inc., Atomic Energy Div. SELF-DIFFUSION OF METALS AND ASSOCIATED PHENOMENA. PART 11. FINAL PROGRESS REPORT [FOR] OCTOBER 1, 1953 TO MARCH 31, 1954. R. W. Balluffi, F. D. Rosi, and L. L. Seigle. Apr. 5, 1954. 9p. Contract AT-30-1-GEN-367. (SEP-153)

It was found during the dezincification of alpha brass that grain boundaries tend to crack open in thick sheets instead of acting as vacancy sinks. The presence of subgrain boundaries also seems to have an effect upon porosity formation. The destruction of vacancies at grain boundaries was found to cause a shrinkage normal to the plane of the boundary. Observations of the motion of the inert markers in copper wire spools were up because shrinkage of the marked wire compacts was completely inhibited by the graphite markers. The cause of this odd effect is not known. Investigations of slip band formation and stress-strain properties of single crystals have been concluded. (For preceding period see SEP-152.) (auth)

4054

Metals Research Lab., Case Inst. of Tech. INVESTIGATION OF THE MECHANICAL PROPERTIES OF TITANIUM BASE ALLOYS. Nov. 30, 1953. 42p. Contract DA-33-019-ORD-941, Technical Report No. 1. (WAL-401/93-32)

A series of commercial titanium-base alloys containing from 0 to 2.69% vanadium were subjected to the following heat treatments in vacuo: annealing at a subcritical temperature, water quenching from a temperature above the critical range, and aging at various temperatures. The heat-treated alloys were tested for hardness, tensile properties, impact resistance, and fatigue behavior. (auth)

4055

DETECTION OF DEFECTS IN METALLIC OBJECTS BY AN ULTRASONIC METHOD. D. S. Shraiber. Translated from Zavodskaya Lab. 8, 816-25(1939). 28p. (AEC-tr-1606; AERE-Trans-11/5/5/178)

Applications of ultrasonic vibrations in non-destructive testing in metallic objects are reviewed, and principles upon which the method is based are discussed. An apparatus is described for use in ultrasonic testing. (C.H.)

4056

INVESTIGATION OF FERROCHROME-SILICON. N. N. Kurnakov. Translated from Izvest. Sektora Fiz.-Khim. Anal., Inst. Obschei Neorg. Khim. Akad. Nauk S.S.S.R. 17, 209-19 (1949). 16p. Available from Henry Brutcher (Trans. No. 3156), Altadena, Calif. (AEC-tr-1897)

4057

WELDING WITH A CONSUMABLE ELECTRODE IN AN ATMOSPHERE OF PROTECTIVE GASES. K. V. Lyubavskii and N. M. Novoshilov. Translated from Avtogennoe Delo 24, 4-8(1953). 11p. Available from Henry Brutcher (Trans. No. 3140), Altadena, Calif. (AEC-tr-1899)

4058

DEVELOPMENT OF PRIMARY STRUCTURE OF WELDS IN LOW CARBON AND LOW ALLOY STEELS BY ELECTROLYTIC ETCHING. A. A. Rossoshinskii. Translated from Avtomat. Svarka 6, 52-4(1953). 5p. Available from Henry Brutcher (Trans. No. 3071), Altadena, Calif. (AEC-tr-1900)

4059

THE REACTION OF SOLID IRON WITH MOLTEN ALUMINUM ALLOYS CONTAINING ZINC. K. Schneider and H. Kessler. Translated from Metall 7, 608-10(1953). 9p. Available from Henry Brutcher (Trans. No. 3168), Altadena, Calif. (AEC-tr-1901)

4060

MANUFACTURE OF ELECTRODES FOR THE ARC WELDING OF ALUMINUM AND ALUMINUM ALLOYS. L. V. Biryukova. Translated from Avtogennoe Delo 24, 25-6 (1953). 3p. Available from Henry Brutcher (Trans. No. 3153), Altadena, Calif. (AEC-tr-1902)

4061

ELECTRODES FOR THE WELDING OF ACID-RESISTING Cr-Ni-Mo-Ti STEELS. G. A. Ukolov. Translated from Avtomat. Svarka 6, 46-9(1953). 5p. Available from Henry Brutcher (Trans. No. 3188), Altadena, Calif. (AEC-tr-1903)

4062

THE EFFICIENCY OF SOME PROTECTIVE TREATMENTS IN PREVENTING THE OXIDATION OF MILD STEEL AT HIGH TEMPERATURES. A. H. Sully, E. A. Brandes, and R. H. Brown (Fulmer Research Inst.). Metallurgia 49, 165-8(1954) Apr.

The relative effectiveness of chromizing, Al coating, and enameling in providing portection against oxidation of mild steel heated to 700°C for 1000 hr is discussed. Shorter exposures at 800 and 900°C were also given. Chromizing Al coating, and certain enamels afforded adequate protection for 1000 hr at 700°C, but beyond this point only chromizing and, to a lesser degree, Al coating were applicable. The former was the superior material. (J.A.G.)

4063

ANALYTICAL METHODS FOR TITANIUM AND TITANIUM ALLOYS. J. A. Corbett (Univ. of Melbourne, Victoria, Australia). Metallurgia 49, 206-8(1954) Apr.

Various methods used for individual determination of the impurities Fe, Mn, Al, Mg, Si, Cl, C, W, Mo, N, and O in Ti metal and Fe, Mn, Cu, Co, Ni, Cr, Sn, Ta, Al, and Ag in Ti alloys are briefly reviewed. (J.A.G.)

4064

INTERPRETATION OF THE SOLUBILITY OF HYDROGEN IN ZIRCONIUM. S. L. H. Martin and A. L. G. Rees (Univ. College of the West Indies, Jamaica) and (Div. of Industrial Chemistry, C.S.I.R.O., Melbourne, Australia). Trans. Faraday Soc. 50, 343-52(1954) Apr.

The pressure and temperature dependence of the solubility of hydrogen in zirconium and zirconium + oxygen solid solutions has been interpreted in terms of a statistical-mechanical theory of two-component interstitial solid solutions. The interpretation is consistent with the x-ray data on the phases in the Zr + H system. The two-phase region lying between the compositions ZrH and ZrH_2 is reproduced satisfactorily in the calculated isotherms. The derived energy parameters lead to a value for the heat of formation of ZrH_2 of 41.4 kcal/mole, in good agreement with the value determined calorimetrically. The effect of oxygen on the initial solubility of hydrogen in zirconium appears to be due

to the blocking of sites normally available to hydrogen atoms by neighboring oxygen atoms; the saturation solubility is determined by the amount of free metallic zirconium remaining after separation of the oxygen as ZrO_2. (auth)

4065

THE PRODUCTION OF SINGLE CRYSTALS OF METALS AND ALLOYS WITH ANY DESIRED ORIENTATION BY SOLIDIFICATION AT HIGH TEMPERATURE. Hideo Takaki, Shigeo Nakamura, Yoji Nakamura, Jun-ichi Hayashi, Kazuo Furukawa, and Masato Aso (Univ. of Kyoto, Japan). J. Phys. Soc. Japan 9, 204-8(1954) Mar.-Apr.

In order to grow single crystals of metals and alloys with fairly high melting point in large rods with any desired orientation, a method is developed from the Bridgman method, using a vacuum Tammann furnace and porcelain crucibles with no bottom, inserting a seed into the lowest part of the crucible. We have succeeded in obtaining single crystals of 3.2% and 4.0% Si-steel, and pure Ni, 3 mm by 25 cm. The rod axes can be fixed in any desired direction. It is noted that the maximum velocity to lower the crucible and its contents, below which a large crystal can grow at each orientation, shows very large anisotropy. (auth)

4066

MECHANICAL PROPERTIES OF BERYLLIUM FABRICATED BY POWDER METALLURGY. W. W. Beaver and K. G. Wikle (Brush Beryllium Co., Cleveland, Ohio). J. Metals 6, 559-73(1954) May.

A general survey of the mechanical properties of commercially pure beryllium fabricated from powder by vacuum hot pressing and other consolidation methods is presented. The effect of fabrication method, grain size, strain rate, and directionality upon both room and elevated temperature tensile properties is reported. (auth)

4067

MECHANICAL PROPERTIES OF BERYLLIUM COPPER AT SUBZERO TEMPERATURES. J. T. Richards (Penn Precision Products, Inc., Reading, Penna.) and R. M. Brick (Univ. of Pennsylvania, Philadelphia). J. Metals 6, 574-80(1954) May.

Tests have been conducted to determine the mechanical properties of several beryllium copper alloys down to liquid air temperatures. The materials investigated include beryllium–copper, beryllium–cobalt–copper, and beryllium–zinc–copper in the wrought and cast conditions. As a means of evaluation, the influence of cold work and age hardening treatment upon subzero behavior has been observed. The effects of temperature upon both elastic and plastic deformation are also considered. (auth)

4068

INVESTIGATION OF THE GRAIN COARSENING BEHAVIOR OF SOME ALUMINUM ALLOYS. Harold Bernstein (U. S. Naval Gun Gactory, Washington, D. C.). J. Metals 6, 603-6(1954) May.

Grain coarsening tests were carried out on Al-4.5 pct Cu and Al-4.5 pct Si alloys. The effects of three variables, melt composition, pour temperature, and mold temperature, and mold temperature, were determined. It was found that the macrostructure generally coarsened with increased pour and mold temperatures. Coarsening was extreme in the unrefined alloys but was retarded by the active grain refiners like titanium and columbium. The effect of boron was spectacular in suppressing coarsening tendencies. The results of the investigation support the carbide theory of nucleation as opposed to the peritectic theory. (auth)

4069

475°C (885°F) EMBRITTLEMENT IN STAINLESS STEELS. A. J. Lena and M. F. Hawkes (Carnegie Inst. of Tech., Pittsburgh, Penna.). J. Metals 6, 607-15(1954) May.

Changes in hardness, tensile properties, microstructure, electrical resistance, and x-ray-diffraction effects indicate that lattice strains are necessary for the embrittlement of ferritic stainless steels when heated for relatively short times at 475°C. It is suggested that 475°C embrittlement is due to the accelerated formation of an intermediate stage in the formation of σ under the influence of these strains. (auth)

4070

ALLOTROPIC TRANSFORMATIONS AT HIGH TEMPERATURE. James O. McCaldin and Pol Duwez (California Inst. of Tech., Pasadena). J. Metals 6, 619-20(1954) May.

Two methods for thermal analysis of specimens are briefly described, by which allotropic transformations between 1000° and 1900°C may be determined. Results are discussed from tests on Fe, Ti, V, Co, Cr, Re, Os, Rh, Ir, Mo, and Th. (L.M.T.)

4071

CREEP BEHAVIOR OF MAGNESIUM-CERIUM ALLOYS. C. S. Roberts (Dow Chemical Co, Midland, Mich.). J. Metals 6, 634-40(1954) May.

Four binary alloys in this system were creep tested at 300° to 600°F. A photographic study of microstructural changes showed that the outstanding creep resistance results primarily from a potent precipitation hardening locally at grain boundaries. Twinning was correlated with the primary stage and nonbasal slip with the tertiary stage of creep. (auth)

4072

THE WARM PRESSING OF BERYLLIUM POWDER. Norman P. Pinto (Sylvania Electric Products, Inv., Hicksville, N. Y.). J. Metals 6, 629-33(1954) May.

Compacting below the recrystallization temperature was studied. Ideal density was attained at 550° to 600°C using 25 tsi. Compacts have strength and hardness higher than cold worked beryllium. The recrystallization temperature of this highly stressed metal is that of cast, cold worked beryllium and appears independent of passing temperature. (auth)

PHYSICS

4073

Radiation Lab., Univ. of Calif., Berkeley

SPARK DAMAGE AND HIGH VOLTAGE BREAKDOWN OF METALS IN VACUUM AT 14 MEGACYCLES. Paul R. Byerly, Jr., Warren W. Chupp, and Harry G. Heard. Jan. 1954. Decl. with deletions Mar. 9, 1954. 22p. Contract W-7405-eng-48. (AECD-3624; UCRL-2053(Rev.))

Approximate breakdown voltages and spark damage estimates were made for Ag, Ti, 52-S0 Al alloy, 316 stainless steel, and various combinations of Inconel and Cu. A cylindrical electrode was centrally located between parallel plates all within a 14-Mc cavity. A strong magnetic field (8,000 gauss) was directed along the common normal to the side plates and stem. Voltages of the order of 1 Mev were applied. (cf. UCRL-1962.) (auth)

4074

Los Alamos Scientific Lab.

VELOCITY DISTRIBUTIONS OF SLOWED FISSION FRAGMENTS. H. W. Schmitt and R. B. Leachman. [1953]. Decl. Sept. 17, 1953. 8p. Contract [W-7405-eng-36]. (AECD-3630)

The velocity distributions of slowed fission fragments show a "shelf" or "fine structure" which becomes more

prominent as heavier absorbers are used to slow the fission products. Several interpretations are discussed, but the one which seems to explain most satisfactorily the shape of the velocity distributions is attributing the charge discontinuity to an electron configuration in the atom. Detailed calculations of the electron-shell effect are in progress. (J.S.R.)

4075

Foundation for Industrial Research, Univ. of Wichita

SURFACE AREAS OF FINELY DIVIDED MATERIALS. July 1, 1953. 9p. Contract AT(11-1)-203. (COO-141)

Experimental data on the flow of adsorbable gases through porous media are presented. Studies were made of the flow of He and CO_2 through a packed powder bed of Kosmobile 77 and the flow of He, CO_2, and SO_2 through a glass diffusion tube at various temperatures. (This report is a supplement to COO-140.) (J.E.D.)

4076

Foundation for Industrial Research, Univ. of Wichita

SURFACE AREAS OF FINELY DIVIDED MATERIALS. Sept. 1, 1953. 12p. Contract AT(11-1)-203, Suppl. No. 1. (COO-142)

Studies on the surface area and pore size distribution of a set of porous glass diffusion tubes intended to represent a range of pore sizes are reported. He conductance at 0°C was measured for all the tubes, and conductance data and results of the analysis of N adsorption-desorption data are summarized. (cf. COO-140 and COO-141.) (J.E.D.)

4077

Illinois Univ.

THE ELECTRICAL RESISTIVITY OF COLD-WORKED ALUMINUM SINGLE CRYSTALS. [PERIOD COVERED FEBRUARY 1, 1953 TO MAY 1, 1954]. A. Sosin. May 1, 1954. 63p. Contracts Nonr-177-(00), Technical Report No. 10 and [DA-11-022-ORD-1212, Technical Report No. 3]. (NP-5159)

Single Al crystals grown in a vacuum furnace were pulled in a tensile machine at liquid He and liquid N_2 temperatures, and electrical resistance measurements were made before and after annealing by the IR drop method. The primary result obtained was that changes in resistivity due to deformation and annealing are isotropic; several other more or less definite results are discussed. A complete description is given of the apparatus and methods used, and the accuracy of results is discussed. Previous work along this line is reviewed, and special emphasis is placed on a recent article by Broom (Advances in Phys. 3, 27(1954)). (L.M.T.)

4078

RAND Corp.

THERMODYNAMICS OF THE THOMAS-FERMI ATOM AT LOW TEMPERATURES. J. J. Gilvarry. Jan. 15, 1954. Decl. Apr. 20, 1954. 37p. (P-474(RAND))

The statistical theory of Thomas and Fermi, generalized to arbitrary temperature, contains implicitly a complete thermodynamic specification of the atom model. Recently, Brachman has derived expressions on this model for the Helmholtz function, the entropy, and the heat capacity C_V at constant volume. This paper shows that Brachman's results permit one to expand the energy as an asymptotic series in powers of the temperature. With this expansion available, it is possible to exhibit explicitly the thermodynamics of the Thomas-Fermi atom model for the case of a first-order temperature perturbation. The thermodynamic functions for the case of zero temperature can be obtained directly from an analytic expression due to Milne for the energy. In this case, the thermodynamic functions can be made directly accessible by fitting semi-empirically, as a function of atom radius, the pertinent parameters derived from solution of the Thomas-Fermi equation. A corresponding procedure can be carried out in the temperature-perturbed case. The effect of exchange is neglected throughout, which makes the results valid only in the limit of high atomic number at sufficiently high compression. (auth)

4079

RAND Corp.

HYDROGEN WAVE FUNCTIONS. Richard Latter. Mar. 10, 1954. 57p. Contract [W-7405-eng-36], SC-9. (RM-1208 (RAND))

4080

FIRST SOUND MEASUREMENTS IN LIQUID HELIUM. A. Van Itterbeek and G. Forrez (Instituut voor large temperaturen en technische physica, Leuven, Belgium). Physica 20, 133-8(1954) Mar.

Measurements are carried out by means of an ultrasonic interferometer on the velocity of first sound in liquid helium between the boiling point and 1.1°K. The frequencies used are 220, 420, 512, and 800 kc. No dispersion is found for the velocity in helium II. The values still increase below 1.2°K. (auth)

4081

DESIGN AND USE OF TEN-KILOCURIE SOURCE OF GAMMA RADIATION. L. E. Brownell, W. W. Meinke, J. V. Nehemias, and E. W. Coleman (Univ. of Michigan, Ann Arbor). Chem. Eng. Progr. 49, 569-76(1953) Nov.

A detailed description is given of the container and caves for a 10-kilocurie γ source. The use of γ radiation for the destruction of microörganisms, sterilization of foods, sterilization of pharmaceuticals, and promotion of chemical reactions is discussed. (J.S.R.)

4082

ELECTRON CAPTURE AND LOSS BY HEAVY IONS PENETRATING THROUGH MATTER. Niels Bohr and Jens Lindhard (Univ. of Copephagen, Denmark). Kgl. Danske Videnskab. Selsk. Mat.-fys. Medd. 28, No. 7 1-30(1954).

A comprehensive interpretation of the phenomena associated with the passage through matter of highly charged ions is presented. Some general features of the balance between the loss and capture processes are considered, with special reference to the fluctuations in ion charge and the gradual adjustment of the average charge of ions emerging from solids into gases. On the basis of a simplified statistical description of the constitution of ions carrying many electrons, some immediate conclusions are drawn from the measurements of average ion charge and from stopping and ionization effects. Features of the mechanism of electron loss and capture by heavy ions in collisions with atoms are considered, and it is attempted to derive approximate estimates for the cross sections of such processes, especially as regards dependence on ion charge and velocity, and the atomic number of the substance penetrated. On the basis of these estimates, a comparison with experimental evidence as regards the charge of fission ions in gases at low pressures is given. Finally, the effect of the residual ion excitation is considered in connection with the observations on the variation of the ion charge with gas pressure and its abnormally high value in solids. (auth)

4083

LUMINESCENCE OF BERYLLIUM OXIDE. C. E. Mandeville and H. O. Albrecht (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 94, 494(1954) Apr. 15.

Nine different samples of BeO were obtained from eight different suppliers, and all exhibited a detectable long-period phosphorescence as well as energy storage at room temperature (20°C) when excited by cathode rays, x rays, or ultraviolet light. Irradiation by α particles resulted principally in fluorescence. One sample of BeO, excited by cathode rays, decayed over a period of 400 min on

a logI–log$t$ plot with a slope of –0.83. The decay of both visible and ultraviolet portions of the spectrum followed the same law. Spectrographic analyses showed that B, Mg, Al, Si, and Fe could be present as impurities. The afterglow which immediately followed excitation could be considerably enhanced in the case of the less pure samples by ignition at 1400°C. Under cathode-ray excitation, this afterglow equaled in intensity that of the best samples of NaCl–Ag. (auth)

4084

DETERMINATION OF h/e BY A NEW METHOD. F. G. Dunnington, C. L. Hemenway, and J. D. Rough (Rutgers Univ., New Brunswick, N. J.). Phys. Rev. 94, 592-8(1954) May 1.

A new method for the direct determination of h/e has been developed which does not involve the short-wavelength limit of the continuous x-ray spectrum. The excitation potential V_e of helium from the ground state to the $2p^1P_1^\circ$ state is measured as the energy, in electron volts, lost by electrons causing this excitation. Experimentally, this energy is determined as the difference between two voltages. The value of h/e is calculated from the basic equation $h\tilde{\nu}c = V_e e$; here $\tilde{\nu}$ is the wave number of the radiation from helium in the $2p^1P_1^\circ$ state. Four factors make possible an order-of-magnitude increase in precision over other earlier work dependent on excitation or ionization potentials: (1) the difference method of obtaining the excitation potential; (2) a gold evaporation technique which essentially eliminates contact potentials and makes possible a great reduction in surface charges; (3) the high precision in both the slit system and in the uniformity of the magnetic field; and (4) the fact that the absolute magnitudes of the electron beam energy, the magnetic field, and the work function of the cathode do not need to be known. A total of 156 determinations of h/e were made under varying experimental conditions. A multiple correlation analysis of these data shows no significant variation of h/e with experimental conditions. The value obtained with its standard error is $h/e = (1.3790 \pm 0.0002) \times 10^{-17}$ erg · sec/esu. This value is in fairly good agreement with the values found from the short-wavelength limit of the continuous x-ray spectrum and with the indirect value computed from all significant work on atomic constants. (auth)

COSMIC RADIATION

4085

ON THE MECHANISM OF THE COLLISION OF NUCLEONS AT HIGH ENERGIES WITH LIGHT NUCLEI. N. L. Grigorov (Moscow State Univ. im. M. V. Lomonosova, Russia). Doklady Akad. Nauk S.S.S.R. 94, 835-8(1954) Feb. 11. (In Russian).

Results of calculations on the passage of the nucleon component of cosmic rays through the atmosphere are presented. These calculations differ from previous ones in that they are based on experimental data. (J.S.R.)

4086

GENERATION OF PENETRATING PAIRS OF NEUTRAL COMPONENTS OF COSMIC EMISSIONS. A. V. Khrimyan. Doklady Akad. Nauk S.S.S.R. 94, 853-6(1954) Feb. 11. (In Russian).

The generation of penetrating pairs by the neutral components of cosmic radiation was investigated at 3250 m above sea level. The experimental setup is described in detail. A tabulation of the data shows that the impulse of the particle generating the pairs is ~ 10^9 ev/c. (J.S.R.)

4087

THE TEMPERATURE EFFECT OF THE HARD COMPONENT OF COSMIC RAYS. L. I. Dorman. Doklady Akad. Nauk S.S.S.R. 95, 49-52(1954) Mar. 1. (In Russian)

The effect of temperature on the intensity of cosmic rays at ground level was measured. The temperature coefficient of the air layer between 100 and 200 mb was 0.049%/°C, and between 50 and 200 mb it was 0.120%/°C. (J.S.R.)

4088

ABSORPTION OF STAR-GENERATING COMPONENTS OF COSMIC RADIATION AT HEIGHTS OF 4000 M. Zh. Takilaev, M. Ostyakov, and D. Kaipov. Zhur. Eksptl'. i Teoret. Fiz. 23, 456-60(1952) Oct. (In Russian)

The results of a survey of special photographic plates exposed at 4000 m and under different thicknesses of Pb absorbers are reported. The presence of small maxima was indicated in the transition curves of air–Pb for solitary tracks. The effect for stars was considerably smaller than for solitary particles. (tr-auth)

4089

INVESTIGATIONS OF THE STRUCTURE OF COSMIC RAYS AT 1000 m ABOVE SEA LEVEL. N. M. Kocharyan, G. S. Saakyan, M. T. Aivazyan, Z. A. Kirakosyan, and S. D. Kaitmazov. Zhur. Eksptl'. i Teoret. Fiz, 23, 532-42(1952) Nov. (In Russian)

An experimental investigation of the structure of cosmic rays at a height of 1000 m showed that the total number of π mesons stopped in an interval range of $22.2 < R < 28.4$, $28.4 < R < 36.8$, and $36.8 < R < 47$ g/cm^2, whereas less than 5% of the total number of μ mesons stopped in the same range. The ratio of the number of protons with nonionizing paths in the given ranges to the number of protons having ionized paths is equal to 0.52, 0.60, and 0.68. For the interval range $30 < R < 36.5$ g/cm^2 a theoretical determination gives the value ~0.5. Analogous determinations of the relative number of π mesons in the same intervals gives the values 1.8, 0.87, and 0.42 for γ equaling 1.5, 2, and 3. γ is the exponential ratio in the experimental spectra of π mesons. (J.S.R.)

ELECTRONS

4090

Chalk River Project (Canada)

FIVE FIGURE TABLES FOR THE CONVERSION OF ELECTRON MOMENTUM TO ELECTRON KINETIC ENERGY FROM 100 TO 20000 GAUSS-CM. J. L. Wolfson and H. S. Gellman. [1952]. 43p. (PD-255)

Tables are given for the conversion of electron momentum (gauss-cm) to electron kinetic energy (kev). The range in momentum is from 100 to 2000 gauss-cm in steps of 1 gauss-cm, from 2000 to 10,000 gauss-cm in steps of 10 gauss-cm, and from 10,000 to 20,000 gauss-cm in steps of 100 gauss-cm. The values of kinetic energy are given to 5 significant figures. By linear interpolation an accuracy of better than 0.01% can be obtained throughout the range of 100 to 20,000 gauss-cm. (auth)

4091

EFFECTIVE DEPTHS OF SECONDARY ELECTRON EMISSION. N. D. Morgulis and N. G. Nakhodkin (Kiev State Univ. im. T. G. Shevchenko, Russia). Doklady Akad. Nauk S.S.S.R. 94, 1029-32(1954) Feb. 21. (In Russian).

The effective depth of secondary electron emission in a number of metals and semiconductors was measured, and the results tabulated. The data were applied to a more generalized concept of the theory of electron emission. (J.S.R.)

4092

ANGULAR DISTRIBUTION OF PHOTOELECTRONS FROM GAMMA RADIATION OF 0.4 AND 1.3 MEV. Arne Hedgran and Sölve Hultberg (Nobel Inst. of Physics, Stockholm, Sweden). Phys. Rev. 94, 498-9(1954) Apr. 15.

The energy dependence of photoelectron angular distribution was investigated, using γ radiation from Co^{60} (1.33

Mev) and Au^{198} (0.41 Mev) on Cb and Au converters, respectively. The distributions obtained are presented together with a description of the geometry used. (K. S.)

4093
EXCITATION AND IONIZATION FUNCTIONS FOR THE IMPACT OF FAST ELECTRONS. D. Reide (Justus Liebig-Hochschule, Giessen, Germany). Z. Physik 137, 313-17 (1954) Apr. (In German). (cf. 7-1253)

The quantum yields and excitation functions for collisions in Hg vapor of fast electrons were measured and compared with the theoretical excitation function. The curves for the excitation function are in good agreement with the theoretical curves. (J.S.R.)

GASES

4094
Harvard Coll. Observatory, Harvard Univ.
DYNAMICS OF IONIZED MEDIA. (PRELIMINARY REPORT). P. L. Bhatnagar, Max Krook, and Donald H. Menzel. July 15, 1952. 59p. Contract AF 19(604)-146, Scientific Report No. 3. (ATI-173970; U-25341)

4095
Iowa State Coll.
THE ROLE OF TRIPLE COLLISIONS IN EXCITATION OF MOLECULAR VIBRATIONS IN NITROUS OXIDE. Richard A. Walker, Thomas D. Rossing, and Sam Legvold. May 26, 1953. 24p. (NACA-TN-3210)

Results are presented of an investigation to determine the importance of triple collisions in the thermal relaxation process (heat capacity lag) of gaseous mixtures. The experimental work involved the measurement of ultrasonic frequencies of the velocity of sound in mixtures of the basic dispersive gas nitrous oxide and impurity gases nitrogen, helium, and argon. Wide ranges of pressures and concentrations for the gas mixtures were required in the experiments to ascertain the possible effects of triple collisions. The rudiments of the theory of sound dispersion and relaxation phenomena are presented along with an analysis of the manner in which the effects of triple collisions might be determined. (NACA)

4096
Naval Research Lab., Univ. of Wis.
THE EFFECTS OF CONCENTRATION DEPENDENCE OF DIFFUSION COEFFICIENTS. Robert F. Snider and C. F. Curtiss. Feb. 17, 1954. 28p. Contract DA-11-022-ORD-994. (WIS-OOR-9)

The effect of the small concentration dependence of gaseous diffusion coefficients on the solution of the diffusion equations is considered. A method is developed for taking this effect into account in the measurement of diffusion coefficients. The coefficients of diffusion of a gaseous mixture vary slightly with the composition of the mixture. In the present discussion the effect of this small concentration dependence on the solution of the diffusion equations and the effect of this concentration dependence on the measured diffusion coefficients are considered. The diffusion in a binary mixture of gases under conditions of constant temperature and pressure, in a "one-dimensional cell" is discussed. The solution of the diffusion equations is obtained by an approximate method in which it is assumed that the effect of the concentration dependence is small. (auth)

INSTRUMENTS

4097
Livermore Research Lab., Calif. Research and Development Co.
A SUPPLEMENTARY REMOTE CONTROL MANIPULATOR. R. V. Steele and H. B. Thomas. May 1954. 7p. Contract AT(11-1)-74. (LRL-129)

A simple single-arm remotely controlled manipulator is described which has four degrees of freedom. The controls are incorporated in a single arm so that the device can be operated remotely with a minimum of thought and effort. (auth)

4098
National Bureau of Standards
A MULTI-CHANNEL PULSE HEIGHT ANALYZER USING A CR STORAGE TUBE. James A. Cunningham. Apr. 1954. 18p. (NBS-3258)

The pulse-height analyzer described was designed for use with pulsed accelerators such as the 50-Mev betatron and the 180-Mev synchrotron at the National Bureau of Standards. The analyzer utilizes the technique of storing the voltage pulses during the short output duration of the accelerators and then analyzing the information during the dead time. Pulse heights were converted into time intervals by means of an ordinary 3KP1 cathode-ray tube used as a storing device. Simple time gates permitted the construction of a relatively compact multichannel analyzer. (auth)

4099
Research Lab. of Electronics, Mass. Inst. of Tech.
POWER GAIN IN FEEDBACK AMPLIFIERS. S. J. Mason. Aug. 25, 1953. 14p. Contract DA-36-039-sc-100., Technical Report No. 257. (NP-5160)

A linear transistor model (or other linear two-terminal-pair device is imbedded in a lossless passive network N, and the properties of the complete system, as measured at two specified terminal pairs, are described by the open-circuit impedances Z_{11}, Z_{12}, Z_{21}, and Z_{22}. The quantity $U = [|Z_{21}-Z_{12}|^2]/[4(R_{11}R_{22}-R_{12}R_{21})]$, where R_{jk} is the real part of Z_{jk}, is defined as the unilateral gain of the transistor. Quantity U is independent of the choice of N and is (consequently) invariant under permutations of the three transistor terminals and also under replacement of the open-circuit impedances by short-circuit admittances. If U exceeds unity at a specified frequency, then N can always be chosen to make R_{11} and R_{22} positive and Z_{12} zero at that frequency. Quantity U is identifiable as the available power gain of the resulting unilateral structure. An arbitrary coupling network may be decomposed into a portion that accomplishes unilateralization and a remaining complementary portion that provides feedback around the unilateralized structure. Such decomposition brings some of the methods of elementary feedback theory to bear upon nonunilateral-circuit problems and offers a viewpoint from which signal flow and power flow can be simply related. (auth)

4100
Reeves Instrument Corp.
SYMPOSIUM 1 ON REAC TECHNIQUES, MARCH 15-16, 1951, NEW YORK CITY. (PROJECT CYCLONE). Frances Bauer, Louis Bauer, Paul Brock, Ben Manfredi, Hans Meissinger, and Seymour Sherman, eds. 152p. (NP-5165)

4101
Oak Ridge National Lab.
CLOUD CHAMBER FOR MEASURING THE PARTICLE DENSITY OF AN AEROSOL. Bernard G. Saunders. Feb. 19, 1954. 28p. Contract W-7405-eng-26. (ORNL-1655)

This report summarizes the work performed in setting up and calibrating a continuous-action cloud chamber which determines the number of particles in a unit volume of aerosol. (auth)

4102
Radiation Lab., Univ. of Calif., Berkeley
THE GAMMA-RAY PINHOLE CAMERA WITH IMAGE AMPLIFIER. Robert K. Mortimer, Hal O. Anger, and Cornelius A. Tobias. Mar. 1954. 13p. Contract W-7405-eng-48. (UCRL-2524)

The gamma-ray pinhole camera is an instrument that can be used to determine the distribution of radioactive

isotopes in vivo. To increase the sensitivity of the camera, a special gamma-detecting image screen was developed. This consisted of a lattice of sodium iodide crystals adjacent to the photocathode of an electronic image-intensifier tube. The absorption of the gamma image in the lattice results in a corresponding visible-light image with a resulting increase in the number of photons. This visible image is then intensified by the electronic image-intensifier tube. With this instrument it is possible to view directly the image of a gamma-emitting source, although a relatively strong source is required. Photographic integration of the final image allows detection of weaker sources. The ultimate sensitivity, limited by the background of the image intensifier tube, is in the order of 1 to 10 $\mu c/cm^2$. It is possible to resolve sources separated by no less than $\frac{1}{4}$ in. Possible applications of the instrument as well as future developments along this line are discussed. (auth)

4103

SOVIET ELECTRON MICROSCOPES AND THEIR APPLICATION IN RESEARCH. Yu. M. Kushnir. English summary beginning at p.22 of Sovetskaya Elektronnaya Mikroskopiya, 1952. 3p. (AEC-tr-1893)

Soviet electron microscopes are described, and their applications in the fields of biology, chemistry, physics, geology, and metallurgy are discussed briefly. (C.H.)

4104

THE APPLICATION OF (RCA 1P 28)-PHOTOMULTIPLIER TUBES TO THE DETECTION OF WEAK LIGHT INTENSITIES. F. Boeschoten, J. M. W. Milatz, and C. Smit (Rijksuniversiteit, Utrecht, Netherlands). Physica 20, 139-56(1954) Mar.

Two methods are discussed of measuring weak light intensities (varying but slowly with time) with the aid of a photomultiplier tube, namely, the light-chopping method in combination with a phase- and frequency-sensitive measuring device and the counting method, as used, for instance, in scintillation counters. The factors determining the detection limit and the reproducibility of these methods are investigated, notably, the internal amplification factor, the quantum efficiency, and the dark current of the photomultiplier. These factors were found to be different between ten RCA 1P28 tubes operating under the same condition, with an average spread of about two times and an extreme spread of ten times. The output current is generated by a light flux of constant intensity, proved to be constant in time within 1% (the error of measurement) when a well stabilized high-voltage source is used. The dark current, however, turned out to vary irregularly with time. The noise of the photo and dark current measured within a narrow band appeared to exceed the calculated value by a factor 2 to 3, which may be due to a Flicker effect. The optimum operation conditions for measuring weak intensities were found to be obtainable with uniform voltage drop amounting to 60 to 70 v over each stage. The effect of decreasing the thermionic current (the most important component of the dark current) by cooling the tube with liquid air on the useful sensitivity was investigated and so was the alteration of the spectral response curve as a function of the temperature. (auth)

ISOTOPES

4105

CHANGE OF THE ISOTOPIC ABUNDANCE RATIO WITHIN A SPHERE DUE TO DIFFUSION. J. T. Bracken and F. E. Senftle (U. S. Geological Survey, Washington, D. C.). J. Appl. Phys. 25, 267-8(1954) Feb.

An equation is derived for isotopic diffusion in a homogeneous sphere of solvent material embedded in an infinite homogeneous medium of the same solvent material. The mean percent isotope separation, $\bar{S}$, within the sphere is defined as $\bar{S} = (1 - f) \times 10^2$, where f is the isotopic diffusion. (J.S.R.)

ISOTOPE SEPARATION

4106

MODEL TEST FOR CONTINUOUS ISOTOPE SEPARATION. J. Hengevoss and R. Fleischmann (Univ. of Hamburg, Germany). Z. Physik 137, 265-73(1954) Apr. (In German)

In the present work a cylindrical separation tube was operated with air as the experimental gas. The N_2 concentration at the upper end was measured as a function of the diffusion. It is shown that the dependence corresponds completely to the theoretical values as long as the diffusion is less than 1% of the circulation. From the mass measurements the tube constants τ_0 and L were obtained with an experimental certainty of 3%. (tr-auth)

MEASURING INSTRUMENTS AND TECHNIQUES

4107

Norman Bridge Lab. of Physics, Calif. Inst. of Tech. [FUNDAMENTAL RESEARCH IN PRECISION SPECTROSCOPY OF X-RAYS AND GAMMA-RAYS]. THE SPECTROSCOPY OF NUCLEAR GAMMA-RAYS BY DIRECT CRYSTAL DIFFRACTION METHODS. Jesse W. M. DuMond. Mar. 1954. 110p. Contracts N6onr-244, T.O. 4, Special Technical Report No. 28 and AT(04-3)-8, Special Technical Report No. 8. (AECU-2868)

The early history of the development of the idea of using a curved (elastically bent) crystal for x-ray spectroscopy is reviewed, and the basic principles of this type of instrument are discussed. Two ways are cited for adapting the transmission type of curved crystal focusing spectrometer to gamma-ray spectroscopy: (1) with an extended source furnishing converging radiation to the crystal which selectively focuses this in the form of spectral lines on a cylindrically bent photographic emulsion (the conventional method) and (2) with a source of very restricted dimensions and high specific intensity placed on the focal circle and made to explore the different wavelength positions in successive closely spaced settings at each of which the intensity selectively reflected by the crystal is measured by a detector placed in the diverging beam beyond the crystal lamina. For the very short wavelength region the latter is shown to be the more suitable method and this is the one almost exclusively followed with the Mark I instrument. The design and use of a diverging "collimator", indispensable to suppress the direct beam and transmit the selectively reflected beam to the detector, is described. The mechanical design of the Mark I spectrometer, insuring that the reflected beam always stays in exact alignment with the collimator baffle system, and giving, on a precision screw, a linear scale of wavelengths (about 1 x-unit per turn of the screw) is described in considerable detail. The final intensive calibration and study of all minute sources of error is described in full. A section is devoted to the presentation of typical results obtained with the Mark I spectrometer, together with a list of references to all published work to date. Besides the Mark I spectrometer two others are discussed: (1) the Mark II, a projected improvement in which the sine of the angle of rotation of the crystal relative to its "zero" position is measured by a novel form of optical interferometer, and (2) the Mark III now under construction and well advanced at Argonne National Lab. in which the source is to be located in a region of high neutron flux density inside a chain reactor from which the gamma-rays issue through a tube to the crystal on the spectrometer with a focal distance of over 7 meters. (auth)

4108
Phillips Petroleum Co., Atomic Energy Div.
MTR TIME-OF-FLIGHT INSTRUMENTATION. D. R. deBoisblanc and K. A. McCollom. Apr. 22, 1954. 31p. Contract AT(10-1)-205. (IDO-16159)

Time-of-flight instrumentation has been designed for use with the MTR fast chopper. The circuits used with other fast choppers were not directly applicable because of the loss of information arising from high counting rates expected at the MTR. A well-known time division principle employing two ring scalers in a 10 × 10 array establishes 100 consecutive channels of equal time duration. A novel feature of the circuitry reduces the dead time between channels to substantially zero by a means not requiring extremely fast pulse rise times. Channel widths of 0.5, 1.0, 2.0, 5.0, 10 and 20 μsec are available. A continuously adjustable time delay of 0 to 1000 μsec initiated by a light pulse in synchronism with the neutron burst is provided. The run-through of the 100 channels commences at the end of the time delay period. Provisions are included for total detector, total channel, in-pile monitor, and background counts. (auth)

4109
A LARGE-WINDOW RECTANGULAR β GEIGER MUELLER COUNTER. Aleksandar M. Milojević. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 1, 11-16(1952) July. (In English)

The properties and characteristics of a rectangular G-M counter are investigated. It is pointed out that such construction allows the use of large thin windows for low-energy β measurements, giving a wider solid angle and easier construction. The properties of the counter are similar to conventional cylindrical counters. (K.S.)

4110
SUMMATION OF γ-RAY ENERGIES WITH A SINGLE-CRYSTAL SPECTROMETER. Daniel C. Lu and M. L. Wiedenbeck (Univ. of Michigan, Ann Arbor). Phys. Rev. 94, 501-2(1954) Apr. 15.

Multi-γ coincidences were effectively observed with a simple modification of a scintillation spectrometer. This was accomplished by drilling a hole 3 mm in diameter along the axis of a cylindrical NaI(Tl) crystal from the top surface to the center. The bottom surface was coupled to a photomultiplier in the usual manner. This allowed the source to be placed outside of the crystal or at its center. With the source within the crystal there is a reasonable probability that all prompt, cascade γ rays from a single disintegration will be absorbed and thus give a pulse corresponding to the sum of the γ energies involved. As such this device can often yield data not readily obtained with the conventional arrangement of spectrometers in coincidence. (auth)

4111
BUBBLE TRACKS IN A HYDROGEN-FILLED GLASER CHAMBER. John G. Wood (Univ. of Calif., Berkeley). Phys. Rev. 94, 731(1954) May 1.

The photography of bubble tracks in H_2 irradiated with a Po–Be source is reported. (L.T.W.)

4112
EFFECT OF CHAMBER VOLTAGE ON ELECTRON BUILD-UP MEASUREMENTS. Jasper E. Richardson (Oak Ridge Inst. of Nuclear Studies, Tenn.). Radiology 62, 584-88 (1954) Apr.

With the use of parallel-plate-type ionization chambers for electron build-up measurements, it is advisable that the voltage be reversed and readings be taken for each polarity. The average of the two readings is the true ionization within the active volume of the chamber. (auth)

MESONS

4113
EVIDENCE FOR THE EXISTENCE OF TWO TYPES OF HEAVY MESONS GIVING A SECONDARY μ MESON. Tchang Fong Hoang, Louis Jauneau, Georges Kayas, Louis Leprince-Ringuet, Daniel Morellet, Agnès Orkin-Lecourtois, and Jacques Trembley. Compt. rend. 238, 1633-5(1954) Apr. 22. (In French)

A heavy meson was observed which yielded a secondary μ meson of 33 Mev, when stopped in an emulsion. The mass of the primary, measured by four methods, is 1170 ± 54, apparently different from that of the Kμ meson. The result, considered in relation to already published observations, shows that two types of K mesons probably exist, both giving μ mesons. (tr-auth).

4114
ANGULAR DISTRIBUTION OF PHOTOMESONS GENERATED BY NUCLEI. A. M. Baldin and V. V. Mikhailov (Physics Inst. im. P. N. Lebedeva). Zhur. Eksptl'. Teoret. Fiz. 23, 481-2(1952) Oct. (In Russian)

The angular distribution of photomesons generated by nuclei was calculated for scalar and pseudoscalar mesons. Reference is made to the theoretical investigation of the formation of charged mesons with γ quanta (M. Lax and H. Feshback, Phys. Rev. 81, 189(1951)) in which an error was made. (tr-auth)

4115
THEORETICAL AND EXPERIMENTAL DATA ON THE FORMATION OF PARTICLES AT HIGH ENERGIES. I. L. Rozental and D. S. Chernavskii. Uspekhi Fiz. Nauk 52, 185-238(1954). (In Russian)

The formation of mesons by the high-energy interaction of nucleons with nucleons and of nucleons with complex nuclei is reviewed. The existence of multiple processes are discussed. The theoretical and experimental data are compared. 57 references. (J.S.R.)

4116
NUCLEAR FISSION OF HEAVY MESONS. Yu. G. Degtyarev, A. P. Zhdanov, and P. I. Lukirskii. Doklady Akad. Nauk S.S.S.R. 94, 843-4(1954) Feb. 11. (In Russian).

In thick nuclear plates exposed to cosmic rays a track 460 μ long was observed which split into three tracks. The original particle had a mass of 1220 ± 170 m_e. Two of the daughter particles are protons with energies 21 and 14 Mev, and the third is an α particle with energy 37 Mev. The original particle was probably either an η or χ meson. (J.S.R.)

4117
FREQUENCY OF SLOW COSMIC-RAY μ-MESONS STOPPED IN THE PHOTOGRAPHIC EMULSIONS AT 23 M.W.E. UNDERGROUND. Shin-ichi Kaneko, Tadayoski Kubozoe, and Masaomi Takahata (Osaka City Univ., Japan). J. Phys. Soc. Japan 9, 147-9(1954) Mar.-Apr.

The absolute frequency of slow μ mesons stopped in the photographic emulsions at a depth of 23 m.w.e. underground was measured. The result is 0.22 ± 0.03 particles/cm^3/day, which is greater than the value published by George and Evans by a factor of about 2.5. (auth)

4118
EFFECT DEUTERON FORMATION ON MULTIPLE MESON PRODUCTION. K. A. Brueckner and J. S. Kovacs (Indiana Univ., Bloomington). Phys. Rev. 94, 726-7(1954) May 1.

Three types of final-state interactions can be expected to be appreciable in multiple meson production, namely, the nucleon-nucleon, meson-nucleon, and meson-meson interactions. This note points out the importance of the first of

these, which manifests itself most simply through deuteron formation. (L.T.W.)

4119

PHOTOPRODUCTION OF π^+ MESONS FROM HYDROGEN NEAR THRESHOLD. G. Bernardini and E. L. Goldwasser (Univ. of Illinois, Champaign). Phys. Rev. 94, 729(1954) May 1.

The photoproduction of π^+ mesons from H near the meson threshold was studied, and the differential cross sections per unit solid angle in the center-of-mass system, measured at 175-, 185-, and 195-Mev photon energy in the laboratory system, are shown. At these low energies an interpretation of the data can be given in terms of a predominant S wave. It is apparent that the momentum dependence is very closely linear and is consistent with the S-wave interpretation. (L.T.W.)

4120

STRANGE PARTICLES AND MULTIPLE MESON PRODUCTION. Giuseppe Cocconi (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 94, 741-2(1954) May 1.

The large number of "strange" particles discovered in the last few years among the products of the interactions of high-energy cosmic rays with matter has brought confusion among physicists, since no theory is able to give a justification of their existence and of their properties. On the other hand, the very facts that these particles are so many and that they all disintegrate with lifetimes around 10^{-10} sec (actual limits: $\sim 10^{-9}$ and $\sim 10^{-11}$ sec) and mass excesses Q around 100 Mev (actual limits: ~30 and ~250 Mev) can be interpreted as an indication that these particles are not to be considered as many separate species. In this paper it is proposed that the strange particles are "compounds" of "elementary" particles, compounds which can be formed whenever the energy available is sufficiently high. "Elementary" particles denote here, besides the nucleons, the particles which can be considered as quanta of a strongly interacting field and thus can be created directly by the excitation of the field. In discussing multiple production this definition seems to be applicable only to the π mesons. The word "compound" is used instead for a particle which, to be created, requires the presence of two or more elementary particles in appropriate spatial and kinematical conditions. (auth)

MOLECULAR PROPERTIES

4121

INELASTIC COLLISIONS BETWEEN TWO MOLECULES. Takechiyo Inoue (Meiji Univ., Tokyo, Japan) and Takehito Takahashi (Seizyo Univ., Tokyo, Japan). J. Phys. Soc. Japan 9, 199-203(1954) Mar.-Apr.

The collision between two diatomic molecules is treated quantum mechanically. Group theoretical arguments are used, and the differential equations for the internal wave functions are derived. The procedure is due originally to Curtiss and Adler, but is more direct and suitable for collision problems. The equations are solved by Zener's method, and transition probabilities are obtained in terms of integrals of interaction potential and a set of phase shifts. It is also shown that the collision between two polyatomic molecules can be treated in quite similar way. (auth)

NUCLEAR PHYSICS

4122

SPECTRUM OF BREMSSTRAHLUNG EMISSION IN THE ATMOSPHERE. M. L. Ter-Mikaelyan. Doklady Akad. Nauk S.S.S.R. 94, 1033-6(1954) Feb. 21. (In Russian).

It is shown that the Bethe-Heitler equation is applicable for the bremsstrahlung spectrum in cases where the frequency $\omega \gg \sqrt{\frac{4\pi Ne^2}{m}\frac{E}{mc^2}}$, but for cases where $\sqrt{\frac{4\pi Ne^2}{m}} < \omega < \sqrt{\frac{4\pi Ne^2}{m}\frac{E}{mc^2}}$, the formula describing the atmospheric bremsstrahlung spectrum is $dI = \frac{E^2 m}{12\pi^2 LN}\frac{\omega^2 d\omega}{E^2}$, where L is the length of the radiation unit is cm, E_s is 21 Mev, and N is the number of electrons per unit volume. (J.S.R.)

4123

PRODUCTION OF ANTIPROTONS IN p-p COLLISIONS. David Fox (Univ. of California, Berkeley). Phys. Rev. 94, 499(1954) Apr. 15.

The cross section for the production of a proton pair by the collision of two protons has been calculated in the neighborhood of threshold, using the formalism suggested by Feynman for the solution of such problems. (auth)

4124

PROTON-NEUTRON MASS DIFFERENCE. R. P. Feynman and G. Speisman (California Inst. of Tech., Pasadena). Phys. Rev. 94, 500(1954) Apr. 15.

It is argued that the mass difference between neutral and charged mesons and the neutron-proton mass difference are of electrodynanic origin. (K.S.)

4125

PRODUCTION OF PROTON PAIRS. R. N. Thorn (Harvard Univ., Cambridge, Mass.). Phys. Rev. 94, 501(1954) Apr. 15.

The cross section for proton pair production near threshold (5.6 bev) is calculated. Both (p,p) and (n,p) processes are considered, and it is concluded that (n,p) production is predominant at threshold. (K.S.)

4126

ENERGY SPECTRA OF NUCLEONS EVAPORATED FROM A COMPOUND NUCLEUS. R. M. Eisberg (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 94, 739-40(1954) May 1.

Previous experiments have shown that there are more high-energy nucleons emitted from a compound nucleus, compared to the number of low-energy nucleons emitted, than can be explained by a Maxwellian distribution. Gugelot (Phys. Rev. 93, 425(1954)) proposed that the excess of high-energy nucleons is due to due to a direct interaction between the incoming particle and the nucleons forming the surface of the target nucleus. The present note suggests that this explanation is adequate to account for the results obtained from the inelastic scattering of 30-Mev protons by Al and is probably adequate to account for the results obtained from the lower-energy (p,p'), (n,n'), and (p,n) experiments. (L.T.W.)

NUCLEAR PROPERTIES

4127

EXPERIMENTAL BASES OF THE NUCLEAR SHELL MODEL. M. I. Korsunskii. Uspekhi Fiz. Nauk 52, 3-82(1954). (In Russian).

The important experimental data leading to the theoretical development of the nuclear shell model are reviewed. (82 references). (J.S.R.)

4128

COLLECTIVE MODEL AND THE PROPERTIES OF SLIGHTLY EXCITED LEVELS OF A NUCLEUS. L. A. Sliv and L. K. Peker. Doklady Akad. Nauk S.S.S.R. 94, 849-52(1954) Feb. 11. (In Russian).

The use of the collective model, a variation of the nuclear shell model, for the analysis of levels of odd nuclei is discussed. The dependence of the energy of the primary excited collective level on the number of neutrons in the nucleus is shown. It is shown that the spin-orbital splitting of the levels depends on the filled

condition of the neutron level. The energy of the collective level of odd nuclei is compared with the energy of the first excited level of even nuclei. (J.S.R.)

4129

INVESTIGATION OF THE ENERGETIC LEVELS OF THE NUCLEI OF ALUMINUM AND BORON BY THE METHOD OF MAGNETIC ANALYSIS. L. M. Khromchenko. Doklady Akad. Nauk S.S.S.R. 94, 1037-40(1954) Feb. 21. (In Russian).

Al targets were bombarded with 3-and 4-Mev deutrons, and the protons emerging were analyzed in a magnetic spectrograph. Twenty-eight proton groups were assigned to the $Al^{27}(d,p)$ Al^{28} reaction. The Q value corresponding to the Al^{28} ground state was measured as 5.475 Mev. The spectra of B^{11} and B^{12} were also investigated, and the Q values of the levels are tabulated. (J.S.R.)

4130

THE ELECTRIC QUADRUPOLE SPLITTING OF THE NUCLEAR MAGNETIC RESONANCE LINES OF SODIUM IN A SINGLE CRYSTAL OF $Na_2S_2O_3 \cdot 5H_2O$. Junkichi Itoh, Riichiro Kusaka, and Yukio Yamagata (Osaka Univ., Japan). J. Phys. Soc. Japan 9, 209-18(1954) Mar.-Apr.

Splitting of the nuclear magnetic resonance lines of Na due to the nuclear electric quadrupole interaction was measured in a single crystal of $Na_2S_2O_3 \cdot 5H_2O$. Since each molecule contains two Na nuclei which have different electric quadrupole interactions, and there are two groups of molecules with different orientations in a unit cell, twelve lines were observed in general. The experimental results were compared with the theoretical calculation of Bersohn and the values of e^2qQ, η, and the directions of the principal axes of the field gradient tensor were determined for each nucleus. The values of e^2qQ and η are 2.26 Mc/sec and 0.334, and 0.830 Mc/sec and 0.41 respectively for two nuclei in the molecule. (auth)

4131

INTERMEDIATE COUPLING CALCULATIONS IN THE UNIFIED NUCLEAR MODEL. D. C. Choudhury (Univ. of Copenhagen, Denmark). Kgl. Danske Videnskab. Selsk. Mat.-fys. Medd. 28, No. 4, 1-15(1954).

The intermediate-coupling treatment of the unified nuclear model, discussed by A. Bohr and B. Mottelson, is extended to a study of the nuclear level structure for a single $j = 5/2$ particle coupled to the nuclear surface oscillations of the quadrupole type. Magnetic moments and quadrupole moments for the nuclear ground states for $j = 5/2$ and $j = 7/2$ configurations are also considered. Wave functions are used, including all unperturbed states with up to three phonons, and the energies and moments are calculated as a function of the coupling strength. The inclusion of states with still more phonons is needed to make detailed contact with the strong-coupling region. However, even for the intermediate-coupling strength for which the present results are valid, various features of the strongly coupled system are beginning to develop. (auth)

4132

NUCLEAR SPIN OF Am^{243} AND ISOTOPE SHIFT IN THE AMERICIUM SPECTRUM. John G. Conway and Ralph D. McLaughlin (Univ. of California, Berkeley). Phys. Rev. 94, 498(1954) Apr. 15.

The hyperfine structure of Am^{243} was found to be a flag pattern of 6 lines, indicating a nuclear spin of 5/2. Within 2%, the patterns of Am^{243} and Am^{241} have the same overall width, showing that their nuclear magnetic moments are equal. A table is presented of the isotope shifts between Am^{241} and Am^{243}. (K.S.)

4133

SCATTERING OF FAST NEUTRONS IN LIGHT NUCLEI. C. F. Cook and T. W. Bonner (Rice Inst., Houston, Texas). Phys. Rev. 94, 651-3(1954) May 1.

The total cross sections of hydrogen, deuterium, lithium, beryllium, B^{10}, B^{11}, carbon, oxygen, magnesium, aluminum, and sulfur have been measured for neutrons whose energies were varied from 14 to 18 Mev. All elements except carbon exhibit a decrease in cross section with increasing energy. Carbon exhibits a broad resonance at 16-Mev neutron energy. Nuclear radii calculated from these cross sections have the following values in units of 10^{-13} cm: Li—3.29, Be^9—3.51, B^{10}—3.56, B^{11}—3.49, C^{12}—3.41, O^{16}—3.85, Mg—4.04, Al—3.98, and S—4.33. The n–p and n–d cross sections are compared with the theoretical calculations. (auth)

4134

SHELL EFFECTS IN HIGHLY EXCITED NUCLEI. Henry W. Newson and Robert H. Rohrer (Oak Ridge National Lab., Tenn.) Phys. Rev. 94, 654-8(1954) May. 1.

The boron absorption method has been used to obtain the following estimates of the energy of the lowest neutron resonance for each of the following target nuclides: Rb^{85}, 0.97 kev; Rb^{87}, 0.42 kev; Y^{89}, 5.0 kev; La^{139}, 0.08 kev; Pr^{141}, 0.38 kev; and Tl^{205}, 10 kev. The corrections were made in such a way that the figure found is a lower limit for the energy and consequently a lower limit for the order of magnitude of the spacing of s-wave resonances. These figures were added to data in the literature, and a plot of s-level spacing was made which included most target nuclides of odd mass and odd charge. This curve showed roughly symmetric maxima at the neutron magic numbers 50, 82, and 126. The cases where the compound nucleus contains more neutrons than the magic numbers are qualitatively understandable, since these nuclides are in a low state of excitation compared to normal nuclei in their neighborhood. An unusually close level spacing, which would be expected on the basis of excitation energy when there are slightly less than a magic number of neutrons, was not observed. It appears (at least near 126 neutrons and 82 protons) that the shell structure is not broken up to any great extent in the compound nucleus. (auth)

4135

SPINS OF THE LOWEST STATES OF THE K^{40}, P^{32}, AND Al^{28} NUCLEI. Harald A. Enge (Univ. of Bergen, Norway). Phys. Rev. 94, 730-1(1954) May 1.

Suggested spin assignments for the lowest states of K^{40}, P^{32}, and Al^{28}, partly based on the assumption that the (d,p) yield is proportional to $(2I + 1)$, are given. Values for configuration of multiplet, excitation energy, stripping data, spin data, final spin assignment, the ratio $(2I + 1)/(2I_0 + 1)$, and experimental yield ratio are tabulated. (L.T.W.)

4136

THERMAL NEUTRON FISSION CROSS SECTION OF Am^{242m} G. H. Higgins and W. W. T. Crane (Univ. of Calif., Berkeley). Phys. Rev. 94, 735(1954) May 1.

A value of 2950 b was obtained for the fission cross section of Am^{242m}. (L.T.W.)

4137

NUCLEAR POTENTIAL WELL DEPTH. Robert K. Adair (Brookhaven National Lab., Upton, N. Y.) Phys. Rev. 94, 737-8(1954) May 1.

Feshbach, Porter, and Weisskopf (Phys. Rev. 90, 166(1953)) have shown that the pattern of variation of the total cross sections of heavy nuclei with neutron energy and nuclear size can be explained by representing the neutron nucleus interactions as that of a square well with absorption $V(r) = -19$ Mev $(1 + i0.05)$, $0 \leq r \leq R \equiv 1.45\ A^{1/3} \times 10^{-13}$ cm; $V(r) = 0$, $r > R$. Bohr and Mottelson (Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 27, 159(1953))

have pointed out that the value of 19 Mev used for the real part of the potential is considerably smaller than that necessary to account for the bound levels of heavy nuclei as described by the shell model. The present note shows that a well depth of ~ 40 Mev, consistent with the shell model, is indicated by the scattering data. (L.T.W.)

4138

STATISTICAL FACTORS IN RADIATION WIDTHS OF NUCLEAR ENERGY LEVELS. D. J. Hughes (Cavendish Lab., Cambridge, England). Phys. Rev. 94, 740-1(1954) May 1.

Some of the statistical factors to be considered in evaluating radiation widths of nuclear energy levels are briefly described. (L.T.W.)

NUCLEAR REACTORS

4139

Oak Ridge National Lab.

OAK RIDGE NATIONAL LABORATORY REACTOR CONTROLS COMPUTER. J. J. Stone and E. R. Mann. Apr. 20, 1954. 44p. Contract W-7405-eng-26. (ORNL-1632)

The general theory and design of reactor simulators is discussed. Specific reference is made to the ORNL Reactor Controls Computer, employing electronic d-c amplifiers whose functional behavior is determined by plug-in impedence networks. The computer, or simulator, contains 20 such amplifiers, and by design of appropriate plug-in units and proper coupling of amplifiers, a wide variety of systems may be simulated. (K.S.)

4140

NUCLEAR REACTORS AND POWER PRODUCTION. II. Christopher Hinton (Risley, England). Atomics 5, 147-51 (1954) May.

The design and construction of the British Windscale piles are discussed. (K.S.)

NUCLEAR TRANSFORMATION

4141

GAMMA-RAYS FROM PROTON CAPTURE IN ^{26}Mg. J. C. Kluyver and G. Verploegh (Rijksuniversiteit te Utrecht, Netherlands). Physica 20, 178-80(1954) Mar.

Gamma rays produced by the resonance capture of 454-kev protons in natural Mg have been investigated with a scintillation spectrometer. The resonance has been assigned to the reaction $Mg^{26}(p,\gamma)Al^{27}$. (L.T.W.)

4142

EMISSION OF PHOTONS ACCOMPANYING THE CAPTURE OF FAST PROTONS BY NUCLEI. A. I. Akhiezer and I. Ya. Pomeranchuk. Doklady Akad. Nauk S.S.S.R. 94, 821-3(1954) Feb. 11. (In Russian).

The cross section for the emission of photons from the nuclear stopping of protons was determined by assuming that protons are described by the Dirac equation and that nuclei appear absolutely black. (J.S.R.)

4143

STUDY OF PHOTO DISINTEGRATIONS WITH THE AID OF PHOTOGRAPHIC EMULSIONS. PHOTO DISINTEGRATION OF CARBON INTO THREE α PARTICLES. II. Raymond Chastel (Collège de France, Paris). J. Phys. radium 15, 240-50(1954) Apr. (In French)

A study of the reaction $C^{12}(\gamma,3\alpha)$ is preceded by an analysis of the corrective factors in the determination of the amount of radiation received at each point of the plate (correction for the solid angle of irradiation and for the variation in the transmission of the filtration screen used). The reconstitution of the nuclear phenomena which are produced in the nuclear emulsion and the precision of the microscopic measurements are discussed. The discrimination of the disintegration stars from those of the reaction $C^{12}(n,n',3\alpha)$ produced by parasitic neutrons is discussed. A detailed discussion of the different hypotheses relative to the mechanism of the reaction is given. In addition to the transformation by the intermediary of the nucleus Be^8, either in its ground state or in an excited state, the mechanism of the tripartition of the nucleus C^{12} excited by 14.8- and 17.6-Mev radiations is examined. (tr-auth)

4144

(p,pn) AND (p,αn) EXCITATION FUNCTIONS. B. L. Cohen, E. Newman, R. A. Charpie, and T. H. Handley (Oak Ridge National Lab., Tenn.). Phys. Rev. 94, 620-5(1954) May 1.

Excitation functions for (p,pn) and (p,αn) reactions were measured with the internal 23.5-Mev proton beam of the ORNL 86-inch cyclotron. Methods of obtaining homogeneous and known incident energy are described. The results indicate that, as found previously, emission of charged particles is much more probable than predicted by the statistical theory of nuclear reactions but that this cannot be explained, as has been proposed, by the lowering of the Coulomb barrier due to oscillations of the compound nucleus or by difficulties with the energy level density formula at low excitation energy. (auth)

4145

ANGULAR DISTRIBUTIONS OF FISSION FRAGMENTS FROM 22-MEV PROTON-INDUCED THORIUM FISSION. B. L. Cohen, W. H. Jones, G. H. McCormick, and B. L. Ferrell (Oak Ridge National Lab., Tenn.). Phys. Rev. 94, 625-9 (1954) May 1.

The angular distributions of barium, strontium, zirconium, ruthenium, and silver fission products from thorium fission induced by 22-Mev protons were measured using the internal, circulating beam of the ORNL 86-inch cyclotron. Within the accuracy of the measurements, all angular distributions are symmetric about 90° and may be well fitted to $I(\theta) = a + b\cos^2\theta$. For Ba, Sr, Zr, Ru, and Ag fission products, for which the fission mass ratios are 1.53, 1.52, 1.37, 1.19, and 1.04, the anisotropy (b/a) is 0.26, 0.25, 0.19, 0.15, and 0.10, respectively. (auth)

4146

GAMMA RAYS AND INTERNAL PAIRS FROM $Be^9 + H^1$. R. J. Mackin, Jr. (California Inst. of Tech., Pasadena). Phys. Rev. 94, 648-50(1954) May 1.

Gamma radiation following the reaction $Be^9(p,\alpha)Li^{6*}$, resonant at $E_p = 2.56$ Mev, has been studied with a magnetic lens spectrometer. The gamma-ray energy, determined from photo- and Compton-electron spectra, is found to be 3.572 ± 0.012 Mev, not corrected for a possible 26-kev Doppler shift. The internal pair (positron) spectrum agrees most closely (to 4.5 percent) with the assignment of the radiation as magnetic dipole. Electric quadrupole is less likely and all other assignments are excluded. The magnetic-dipole character is consistent with the identification of the 3.57-Mev level of Li^6 as the analog of the He^6 ground state with $J = 0^+$, $T = 1$. Reaction data are analyzed to suggest that the resonant state of the compound nucleus (the 8.89-Mev level of B^{10}) has $J = 2^+$, $T = 1$. (auth)

4147

NUCLEAR REACTIONS OF COPPER WITH 2.2-BEV PROTONS. G. Friedlander, J. M. Miller, R. Wolfgang, J. Hudis, and E. Baker (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 94, 727-8(1954) May. 1.

The circulating proton beam of the Brookhaven Cosmotron has been used to determine the cross sections for the formation of about 50 radioactive nuclides in the bombardment of Cu with 2.2-bev protons. (L.T.W.)

4148

GALLIUM, GERMANIUM, AND ARSENIC NUCLIDES PRODUCED IN THE BOMBARDMENT OF COPPER WITH 2.2-

BEV PROTONS. Anthony Turkevich and Nathan Sugarman (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 94, 728(1954) May 1.

Formation of the isotopes Ga^{66}, Ga^{67}, Ga^{68}, Ge^{66}, Ge^{67}, Ge^{69}, As^{71}, and As^{72} by 2.2-bev proton bombardment of Cu is reported. (L.T.W.)

4149

ANGULAR ANISOTROPY OF SPECIFIC THORIUM PHOTOFISSION FRAGMENTS. A. W. Fairhall, I. Halpern, and E. J. Winhold (Mass. Inst. of Tech., Cambridge). Phys. Rev. 94, 733-4(1954) May 1.

The number of fragments emitted per unit solid angle from Th at 90° to the 16-Mev x-ray beam from the MIT linear accelerator was compared to the average of the numbers at 0 and 180° for the seven fission product elements Br, Ag, Sb, Te, I, Ba, and Ce. Over the range measured, the anisotropy appears to be a monotonically increasing function of the mass ratio of the fission fragment pairs. (L.T.W.)

4150

ELECTRIC EXCITATION OF TANTALUM. J. T. Eisinger, C. F. Cook, and C. M. Class (Rice Inst., Houston, Texas). Phys. Rev. 94, 735-6(1954) May 1.

Ta^{181} was bombarded with 3-Mev protons, and γ rays of 139, 167, and 309 kev, to an accuracy of 5 kev, were observed, in agreement with the more accurate measurements of 137, 166, and 303 kev. The relative probabilities of γ-ray transitions from the 303-kev level directly to the ground state, and through the 137-kev level, were determined. The angular distributions of the 137- and 303-kev γ rays from Ta^{181} between 0 and 90° to the 3-Mev proton beam were measured. The angular distribution function is shown. (L.T.W.)

PARTICLE ACCELERATORS

4151

THE EFFECT OF FIELD BUMP IN A STRONG FOCUSING SYNCHROTRON. Kazuo Huke and Giiti Iwata (University of Tokyo, Japan). J. Phys. Soc. Japan 9, 297-8(1954) Mar.-Apr.

Equations are derived for the effect of field curvature on the strong-focusing of a synchrotron. (K.S.)

RADIATION ABSORPTION AND SCATTERING

4152

Knolls Atomic Power Lab.

THE ABSORPTION OF TRITIUM BETA-PARTICLES IN HYDROGEN AND OTHER GASES. L. M. Dorfman. Mar. 11, 1954. 35p. Contract W-31-109-eng-52. (KAPL-1086)

The absorption curves for tritium beta particles in hydrogen and helium have been determined by using a spherical ion chamber in which the particular gas serves both as the absorber and the ionization medium. The absorption curves give half-thickness values of 0.031 mg/cm^2 for hydrogen and 0.061 mg/cm^2 for helium. From the saturation currents obtained with a given amount of tritium the relative energy requirement per ion pair has been measured for hydrogen, helium, oxygen, and argon. These values are compared with recent values in the literature. (auth)

4153

Nuclear Development Associates, Inc.

ESTIMATES OF THE EFFECT OF FLUORESCENCE AND ANNIHILATION RADIATION ON GAMMA RAY PENETRATION. H. Goldstein. Feb. 26, 1954. 22p. Contract AT(30-1)-862. (NDA-15C-31)

In the extensive NDA-NBS program of γ-ray penetration calculations, no account was taken of the generation of additional photons as fluorescence and annihilation radiation. Estimates have therefore been made of the contribution of these sources to the total γ-ray dose. It is shown that these contributions can be calculated to more than adequate accuracy using only the results already obtained by the NDA-NBS program. Fluorescence radiation need be considered only for the heaviest elements and lowest energy sources (< 1 Mev). Even under these conditions it increases the total dose by at most 1 to 2%, which is within the accuracy of the calculations. Annihilation radiation is most important for high-energy sources (6 to 10 Mev) and medium to heavy elements (Z = 25 to 85). In the worst case it may contribute up to 7% of the total dose, which is barely significant. It completely changes, however, the spectrum of scattered photons below 500 kev, and annihilation radiation must therefore be considered in examining the spectrum in the region.

4154

Oak Ridge National Lab.

THE ATTENUATION OF NEUTRONS BY AIR DUCTS IN SHIELDS. A. Simon and C. E. Clifford. Mar. 8, 1954. Decl. Apr. 22, 1954. 24p. Contract W-7405-eng-26. (ORNL-1217(rev.))

The attenuation of neutrons by air ducts in shields is considered from a simple phenomenological point of view. It is shown that the wall scattering in a straight duct is small compared to the uncollided neutrons which have traveled directly in air from one end of the duct to the other. The attenuation due to a duct which consists of two straight sections joined at an angle is considered. The formula obtained is extended to the case of any number of straight sections joined at arbitrary angles. (L.T.W.)

4155

POLARIZATION OF ELASTICALLY SCATTERED NUCLEONS FROM NUCLEI. Warren Heckrotte and Joseph V. Lepore (Univ. of California, Berkeley). Phys. Rev. 94, 500-1(1954) Apr. 15.

It is shown that nucleon polarization takes place in low- or intermediate-energy nucleons, elastically scattered by nuclei. The effect is attributed to strong spin-orbit potentials in the nuclear shell model. A phase-shift analysis of the theory is in progress. The magnitude of the polarization is approximated by several simplifying assumptions. (K. S.)

4156

PHASE SHIFT ANALYSIS OF HIGH-ENERGY NUCLEON-NUCLEON SCATTERING EXPERIMENTS. R. M. Thaler and J. Bengston (Yale Univ., New Haven, Conn.). Phys. Rev. 94, 679-82(1954) May. 1.

The high-energy proton-proton scattering data are analyzed in terms of s-wave and p-wave anomalies. Different phase shifts are used for the three p waves with total angular momentum j = 0, 1, 2. It is found that the data can be fitted without charge independence of nuclear forces. These high-energy fits vary smoothly with energy and are not in contradiction to the requirements of the intermediate energy (10 to 100 Mev) data. Inversion of nuclear levels suggested by the shell theory of nuclear forces can also be accounted for. (auth)

4157

INTERMEDIATE STATE COUPLING AND THE INTERPRETATION OF HIGH-ENERGY NUCLEON-NUCLEON SCATTERING. R. M. Thaler, J. Bengston, and G. Breit (Yale Univ., New Haven, Conn.). Phys. Rev. 94, 683-9(1954) May 1.

The effect on the scattering of protons by protons of the $^3P_2-{}^3F_2$ coupling due to an intermediate state of the two-nucleon system is investigated. The problem is treated in a

scattering matrix formalism, with total angular momentum $j = 2$, orbital angular momentum $L = j \pm 1$, and partial half-width Γ_L. Only the $^1S_0$, $^1D_2$, $^3P_0$, $^3P_1$, $^3P_2$–$^3F_2$ scattering anomalies are considered. Fits to the experimental data at 240 Mev are studied as typical. For $^1K_0 \approx 31°$, $^1K_2 > 0$ it is found that the data may be reasonably well represented provided $(\Gamma_1 + \Gamma_3)/(E_R - E) \lesssim 0.3$. It has been found possible to fit data on n-p and p-p scattering employing phase shifts agreeing with the hypothesis of charge independence of nuclear forces. Reasonable agreement with experiment is obtained employing either the regular or the inverted order of $^3P_{0,1,2}$ levels. (auth)

4158

INTERACTIONS OF NEGATIVE PIONS IN CARBON AND LEAD. John O. Kessler and Leon M. Lederman (Columbia Univ., New York). Phys. Rev. 94, 689-702(1954) May 1.

A cloud chamber investigation of the nuclear interactions of 125-Mev negative π mesons has been carried out. Carbon and lead were employed as the scattering material. The experimental arrangement was designed to observe the charge-exchange process $\pi^- + C \rightarrow B^{(exc)} + [\pi^0 \rightarrow 2\gamma]$. High-energy photons, probably attributable to charge exchange, are found to arise from nuclear interaction, with a small but finite cross section. Total and differential cross sections for elastic and inelastic scattering, as well as total nuclear reaction cross sections, are presented. A square well (optical model) analysis fits the data with a potential whose real part is attractive and 30 Mev deep, and whose imaginary part corresponds to a mean free path in nuclear matter of 3×10^{-13} cm. The optical model parameters are found to be energy dependent, the well depth increasing and the mean free path decreasing as the energy is raised. (auth)

4159

THE ELASTIC SCATTERING OF PHOTONS. E. G. Fuller and Evans Hayward (National Bureau of Standards, Washington, D. C.). Phys. Rev. 94, 732-3(1954) May 1.

X rays produced by the NBS 50-Mev betatron were scattered from Au, Pb, and U targets about one mean free path thick. The elastic scattering cross sections were measured as a function of energy. (L.T.W.)

RADIATION EFFECTS

4160

North American Aviation, Inc.

EFFECT OF CYCLOTRON IRRADIATION ON CREEP OF ALUMINUM. FINAL REPORT. M. R. Jeppson, R. L. Mather, and H. P. Yockey. Feb. 12, 1953., Decl. with deletions Feb. 16, 1954. 30p. Contract AT-11-1-GEN-8. (AECD-3631; NAA-SR-206)

Measurements have been made of the effect of cyclotron irradiation on the steady-state creep rate of aluminum at beam densities up to 1.2×10^{13} α particles/cm^2/sec. The data show a slight decrease in rate (up to 19%) during bombardment. Since the effect is small, apparently independent of beam density, and is comparable to the usual deviations in the absence of radiation, it can be considered a null result. (auth)

4161

RESISTIVITY CHANGES IN COPPER, SILVER, AND GOLD PRODUCED BY DEUTERON IRRADIATION NEAR 10°K H. G. Cooper, J. S. Koehler, and J. W. Marx (Univ. of Illinois, Urbana). Phys. Rev. 94, 496(1954) Apr. 15.

Samples of Cu, Ag, and Au were irradiated by 12-Mev deuterons at 12 and 16°K. Radiation-induced resistivity changes were measured, and on holding the samples at irradiation temperature for 48 hr, no change in resistivity was noted. A large drop in the resistivity of Cu and Ag was noted at 40 and 30°K, respectively, with no similar effect at any temperature observed in Au. A gradual decrease in resistivity was found for all samples as the temperature rose, with no change noted above 255°K in Cu, 240°K in Ag, and 285°K in Au. (K.S.)

4162

ATOMIC HYDROGEN HYPERFINE STRUCTURE IN IRRADIATED ACIDS. Ralph Livingston, Henry Zeldes, and Ellison H. Taylor (Oak Ridge National Lab., Tenn.). Phys. Rev. 94, 725(1954) May 1.

Paramagnetic resonance absorption lines have been observed in $HClO_4$, H_2SO_4, and H_3PO_4 after irradiation with Co^{60} γ rays at 77°K and are attributed to free radicals. One of the radicals formed and trapped in the acids was identified as atomic H. (L.T.W.)

RADIOACTIVITY

4163

Radiation Lab., Univ. of Calif., Berkeley

THE DECAY OF THE ODD-ODD ISOMER Tl^{198m}. T. O. Passell, M. C. Michel, and I. Bergström. Mar. 22, 1954. 16p. Contract W-7405-eng-48. (UCRL-2520)

The electron spectrum of Tl^{198m} has been investigated in a 25-cm double-focusing beta spectrometer with a resolution of approximately 0.4 percent. The electron lines have been assigned to three gamma rays with energies (in kev) 261.5, 284, and 48.4, respectively. The multipolarities assigned from conversion ratio and lifetime considerations are M4, M1 + E2, and E2, respectively. A tentative decay scheme is proposed which is consistent with all the available data. (auth)

4164

THE PERIOD OF THE POLYDISINTEGRATION OF P^{30}. K. Baskova and A. Kudryuvtseva (Leningrad State Univ., Russia). Zhur. Eksptl'. i Teoret. Fiz. 23, 483(1952) Oct. (In Russian)

The time for the polydisintegration of Po^{30} is 2.52 ± 0.02 min. The decay curve is given. (tr-auth)

4165

STUDY OF α-γ ANGULAR CORRELATIONS IN Th^{230}. Pierrette Benoist, Jean Teillac, Georges Valladas, and Paul Falk-Vairant. Compt. rend. 238, 1656-8(1954) Apr. 21. (In French)

The results of α-γ correlation studies in Th^{230} are theoretically explained by assuming that the 67.8- and 210-kev excited states of Ra^{226} have spins of 2 and 4 with + parity, that these are rotational levels, and that the correlations are attenuated by coupling of the nuclear quadrupole moment, in the intermediate state, with surrounding electric fields. (tr-auth)

4166

A METHOD FOR THE MEASURING OF LOW ENERGY β-RAY SPECTRA. Tihomir Novakov. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 1, 1-4(1952) July. (In English)

A method for low-energy β-ray spectrum measurements is described which employs a preacceleration of the electrons from a uniform source. (K.S.)

4167

EVIDENCE FOR A $(1f^{7/2})^3_{3/2}$ STATE IN $^{49}_{23}V_{26}$. R. H. Nussbaum, A. H. Wapstra, G. J. Nijgh, L. Th. M. Ornstein, and N. F. Verster (Instituut voor kernphysisch onderzoek, Amsterdam, Netherlands). Physica 20, 165-8(1954) Mar.

Gamma transitions of 63 ± 1 kev (15 ± 2%), 89 ± 1 kev (30 ± 4%), and 150 ± 2 kev (14 ± 2%) (intensities relative to total position activity) were found in the decay of Cr^{49} by means of a single-channel NaI scintillation spectrometer. From γ-γ coincidence experiments the 150-kev line is established to be the cross-over transition. Conversion electrons from the three transitions were found in a

magnetic-lens-type β ray spectrometer. Conversion coefficients were measured from which the assignment M1 (63 kev), M1 (89 kev), and E2 (150 kev) were derived. A level scheme of V^{49} is proposed, involving the states $^7/_2^-$, $^5/_2^-$, and $^3/_2^-$ from the proton configuration $(1f_{7/2})^3$, while $^5/_2^-$ is derived for the ground state of Cr^{49}. (auth)

4168

THE DECAY OF ^{203}Hg, ^{203}Pb AND ^{201}Pb. A. H. Wapstra, D. Maeder, G. J. Nijgh, and L. Th. M. Ornstein (Instituut voor kernphysisch onderzoek, Amsterdam, Netherlands). Physica 20, 169-77(1954) Mar.

Hg^{203} and Pb^{203} have been studied with scintillation and β-ray spectrometers. The transitions to the Tl^{203} ground states are absent in both; both decay to a 279 ± 1-kev state in Tl^{203}(α_K = 0.141 ± 0.015, K/L = 3.30 ± 0.10, L/(M + N) = 3.45 ± 0.3, $E_2 + M_1$). In Pb^{203} 5.1% of the nuclei decay to a 679 ± 2-kev state in Tl^{203}, which emits for 4.3% a 400 ± 2-kev γ ray (α_K = 0.118 ± 0.015, K/L = 6.0 ± 0.4. L/(M + N) = 4.5 ± 0.7, $E_2 + M_1$) and for 0.8% a 678 ± 3-kev γ ray (α_K = 0.009 ± 0.003, E_2). The maximum energy of the Hg^{203} β spectrum is 219 ± 10 kev. In Pb^{201} Pb a 325-kev transition (K/(L + M) = 5 ± 1.5) and a 583-kev transition were found; the half life was 8.4 ± 1 hr. (auth)

4169

BETA-RAY SPECTRUM OF Ag^{110}. Toshio Azuma (Naniwa Univ., Mozu, Sakai, Osaka, Japan). Phys. Rev. 94, 638-9 (1954) May 1.

The soft beta-ray spectrum of Ag^{110} has been measured by a double-coil, magnetic lens beta-ray spectrometer with a thin source and a thin counter window. From the analysis of the Fermi plot, three soft beta-ray groups of allowed type are found, with end points of 80, 314, and 530 kev. The ratio of their intensities is 10.7 : 3.2 : 15.3. (auth)

4170

INNER BREMSSTRAHLUNG OF Cs^{131}. Babulal Saraf (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 94, 642-7(1954) May 1.

The continuous gamma-ray spectrum (inner bremsstrahlung) accompanying orbital electron capture in Cs^{131} has been observed by the method of scintillation spectrometry. The absolute intensity of the gamma radiation has been measured and compared with the total disintegration rate. The end point of the gamma-ray distribution was found to be 320 ± 10 kev. The experimentally determined shape of the spectrum, as well as the intensity of the continuum, is compared with theoretical calculations. The disagreement exceeds considerably that which might be expected from a consideration of the probable errors of the observations. The growth of the 12-day isomer of Xe^{131} was not detected. (auth)

4171

NUCLIDE V^{53}. Raymond K. Sheline and Joseph R. Wilkinson (Florida State Univ., Tallahassee). Phys. Rev. 94, 729-30(1954) May 1.

A search for the nuclide V^{53} was made by bombarding separated Cr^{53} with neutrons, the expected reaction being $Cr^{53}(n,p)V^{53}$. The half life of V^{53} is 23 ± 1 hr, the β energy is 0.56 ± 0.1 Mev, and a complex decay scheme is indicated. (L.T.W.)

4172

DECAY SCHEME OF Xe^{135}. Sigvard Thulin (Nobel Inst. of Physics, Stockholm, Sweden). Phys. Rev. 94, 734-5(1954) May 1.

The decay of Xe^{135} was studied by means of coincidence measurements on electromagnetically separated Xe^{135} samples in an intermediate-image β spectrometer. No coincidences were found between K conversion electrons of the 250-kev γ ray and γ quanta of energy higher than 550 kev. Coincidences were recorded between these K conversion electrons and γ quanta of energy ~ 370 kev. It was shown that the 600-kev γ ray is emitted in cascade with a β continuum. A Fermi plot of the coincidence distribution showed an upper limit of 548 kev. A tentative decay scheme is proposed. (L.T.W.)

4173

NUCLEAR SHELL MODEL ft VALUES FOR INTERMEDIATE COUPLING. R. Schulten and R. A. Ferrell. Phys. Rev. 94, 739(1954) May 1.

The β-decay matrix elements, and thus the ft values, have been evaluated for several of the β transitions among the light nuclei. These theoretical results agree satisfactorily with experiment and indicate that intermediate coupling is to be preferred as a nuclear model over strict LS or j-j coupling. (L.T.W.)

SPECTROSCOPY

4174

Knolls Atomic Power Lab.

A DEFOCUSING EFFECT OBSERVED IN X-RAY SPECTROMETRY. W. E. Seymour. Mar. 31, 1954. 17p. Contract W-31-109-eng-52. (KAPL-1092)

To obtain x-ray data on preferred crystal orientation in some metals, it is necessary to "reflect" the x-ray beam from the metal surface. An important "defocusing effect" has been noticed when this technique is used, which can result in erroneous intensity data and spectral line position. The geometrical optics of the defocusing and corrective measures to be taken are discussed. (auth)

4175

Syracuse Univ.

SHAPE OF COLLISION-BROADENED SPECTRAL LINES. E. P. Gross. Apr. 1954. 30p. Contract AF-18(600)-459. (NP-5150)

V. Vleck and Weisskopf and Frohlich have derived a microwave line shape by studying the interruption by collisions of the motion of a classical oscillator. They assume that after the instantaneous impact the oscillator variables are distributed according to a Boltzmann distribution appropriate to the value of the applied field at collision. In contrast to the earlier theory of Lorentz, they obtain the correct static polarization. The procedure involves an assumption of very large velocity during collision. This is criticized on the grounds that the duration of collision is short compared to the resonant period, and energy exchanges are of the order of kT. A line-shape formula is derived, assuming that the positions are unchanged after impact. Two extreme models are studied. In one the oscillators have a Maxwellian distribution of velocities after impact; the second is a Brownian motion treatment. The resulting line shape in both cases is that of a friction-damped oscillator. For collision frequency much less than the resonant frequency, the polarization postulated by the above authors is reached as a result of kinematic motion between collisions, and the line shapes agree. However, to obtain equal line widths and peak absorptions the collision frequency is twice as large for the present theory. For collision frequency comparable to resonant frequency a less distorted line-shape results. For testing the theories, experiments on foreign-gas broadening in the microwave region at pressures of the order of an atmosphere are required. Differences between the theories are small for conditions accessible experimentally at present. (auth)

THEORETICAL PHYSICS

4176

Maryland Univ.

SELF-ENERGY EFFECTS ON MESON–NUCLEON SCAT-